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CRREL TECHNICAL PUBLICATIONS

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CR 85-19
MODEL STUDIES OF SURFACE NOISE INTERFERENCE IN GROUND-PROBING RADAR
Arcone, S.A. et al
Nov. 1985
23p.
ADA-163 208
12 refs.
41-447
Delaney, A.J.
Radar echoes, Noise (sound), Polarization (waves), Countermeasures, Electrical properties, Antennas, Tests, Models
Ground-probing radar can be an effective tool for exploring the top 10 to 20 m of ground, especially in cold regions where the freezing of water decreases signal absorption. However, the large electrical variability of the surface, combined with the short wavelengths used, can often cause severe ground clutter that can mask a desired, deeper return. In this study a model facility was constructed consisting of a metallic reflector covered by sand. Troughs of saturated sand were emplaced at the surface to vary surface electrical properties and to act as a noise source to interfere with the bottom reflections. Antenna polarization and height, and signal stacking in both static (antennas stationary) and dynamic (antennas moving) modes were then investigated as methods for reducing the surface clutter. Polarization parallel to the profile direction (perpendicular to the troughs' axes) gave profiles superior to the perpendicular case because of the directional sensitivity of the antenna radiation.

CR 86-02
BRITTLENESS OF REINFORCED CONCRETE STRUCTURES UNDER ARCTIC CONDITIONS
Kivekäs, L. et al
May 1986
20p.
ADA-170 792
9 refs.
41-213
Korhonen, C.
Reinforced concretes, Brittleness, Concrete structures, Transportation, Cold weather tests, Cracking (fracturing)
The behavior of reinforced and unreinforced concrete beams was studied under impact loading at low temperatures, and the results were compared to the behavior of reinforcing steel (rebar) in Charpy-V impact tests. Transition temperatures as low as -30 C were obtained for the rebars in the Charpy-V tests, whereas no brittle failures occurred in the rebars in the reinforced concrete beams at temperatures as low as -63 C, even in beams where the rebars were intentionally notched. The impact strength of unreinforced concrete increases considerably at lower temperatures, thus reducing cracking of reinforced concrete structures and significantly increasing the safety of lightly reinforced structures.

CR 86-04
RESILIENT MODULUS OF FREEZE-THAW AFFECTED GRANULAR SOILS FOR PAVEMENT DESIGN AND EVALUATION. PART 1. LABORATORY TESTS ON SOILS FROM WINCHENDON, MASSACHUSETTS, TEST SECTIONS
Cole, D. et al
July 1986
70p.
ADA-171 541
15 refs.
41-593
Bentley, D. Durell, G. Johnson, T.
Roads, Frozen ground strength, Freeze thaw cycles, Ground thawing, Pavements, Soil strength, Subgrade soils, Loads (forces), Unfrozen water content, Stresses, Soil water
This work is the first of a series of four reports about laboratory and field testing of various granular road and airfield subgrades. This report details the acquisition, testing and analysis of six soils from a test site in Winchendon, Massachusetts. Repeat load triaxial tests were done on frozen and thawed soils to characterize the variations in their resilient properties throughout the seasons. Linear regression yielded empirical equations relating the resilient modulus to applied stress, unfrozen water content (for frozen soils), moisture tension (for thawed soils) and density. Equipment and test procedures (given in detail) were developed that allowed simulation in the laboratory of the gradual recovery of stiffness that occurs in the field after thawing. The resilient moduli were strongly dependent on soil state, dropping at least two orders of magnitude upon thawing.

CR 86-05
EFFECT OF GRAIN SIZE ON THE INTERNAL FRACTURING OF POLYCRYSTALLINE ICE
Cole, D.M.
July 1986
71p.
ADA-171 571
Refs. p.49-51.
41-3479
Ice cracks, Ice crystal structure, Fracturing, Grain size, Ice creep, Photography, Stresses
This work presents the results of a study to examine the effects of grain size on the number and size of internal microfractures in polycrystalline ice. Laboratory-prepared specimens were tested under uniaxial, constant-load creep conditions at -5 C. Grain size ranged from 1.5 to 6.0 mm. This range of grain size, under an initial creep stress of 2.0 MPa, led to a significant change in the character of deformation. The finest-grained material displayed no internal cracking and typically experienced strains of 1/100 at the minimum creep rate. The coarse-grained material experienced severe cracking and a drop in the strain at the minimum creep rate to approximately 4/1000. Extensive post-test optical analysis allowed estimation of the size distribution and number of microcracks in the tested material. These data led to the development of a relationship between the average crack size and the average grain size. Additionally, the crack size distribution, when normalized to the grain diameter, was very similar for all specimens tested. The results indicate that the average crack size is approximately one-half the average grain diameter over the stated grain size range. A dislocation pileup model is found to adequately predict the onset of internal cracking. The work employed acoustic emission techniques to monitor the fracturing activity. This information shed light on the time and strain at which the fracturing began and when the peak fracturing rate occurred. Other topics covered in this report include creep behavior, crack healing, the effect of stress level on fracture size and the orientation of cracked grains. Theoretical aspects of the grain size effect on material behavior are also given.

CR 86-06
SHORT-PULSE RADAR INVESTIGATIONS OF FRESHWATER ICE SHEETS AND BRASH ICE
Arcone, S.A. et al
July 1986
10p.
ADA-172 578
5 refs.
41-594
Delaney, A.J. Perham, R.E.
Ice cover thickness, Radar echoes, Lake ice, Ice sheets, Antennas
Short-pulse radar profiles and waveform traces were recorded over natural, freshwater ice sheets and an artificially made, 1.6-m-diameter column of brash ice. The purpose was to study the feasibility of this type of radar to detect ice thickness, determine ice properties and distinguish ice forms. The radar utilized two antennas: one with a spectrum centered near 900 MHz and a second more powerful one near 700 MHz. Distinct top and bottom reflections from several ice sheets were produced by both antennas, but the value of dielectric permittivity calculated from the time delay of the reflections varied between sheets as one ice sheet was ready to candle and contained free water. The brash ice distorted signals and allowed no discernible bottom return.

CR 86-07
NITROGEN CONTROL IN WASTEWATER TREATMENT SYSTEMS FOR MILITARY FACILITIES IN COLD REGIONS
Reed, S.C.
Aug. 1986
23p.
ADA-173 724
25 refs.
41-859
Military facilities, Waste treatment, Water treatment, Chemical analysis, Sewage treatment, Water pollution, Climatic factors, Filters, Sludges
Nitrogen control in the form of ammonia removal or conversion is required, or will be required, for a significant number of military wastewater treatment systems. This report presents a summary of engineering criteria for those processes in most common use at military facilities in the cold regions. These processes include: trickling filters, treatment ponds, rotating biological contactors (RBC) and activated sludge. A design example is presented for each case. All four processes can achieve significant levels of ammonia removal or conversion. If ammonia discharge limits are 0.5 mg/L or less it may be necessary to use the activated sludge process. Trickling filters or RBC units are recommended for higher (> 1 mg/L) discharge limits. Pond systems are suitable for seasonal ammonia removal in cold climates.

CR 86-08
APPLICATIONS OF THE FINITE-ELEMENT METHOD TO THE PROBLEM OF HEAT TRANSFER IN A FREEZING SHAFT WALL
Liandi, F.
Aug. 1986
24p.
ADA-172 552
12 refs.
41-595
Soil freezing, Shafts (excavations), Heat transfer, Tunnels, Walls, Latent heat, Heat capacity, Analysis (mathematics)
In this work, numerical computations of heat transfer for freezing a shaft wall have been conducted. Both fixed mesh and deforming mesh finite-element methods are used. In the fixed mesh method, latent heat effects are accounted for through a delta function in the apparent heat capacity. In the deforming mesh method, an automatic mesh-generation technique with transfinite mappings is used, and in this method two different approaches are taken to evaluate the movement of the interface. The freeze-pipes are considered as point sources with irregular distribution. The advancement of the inner and outer boundaries of the frozen wall is found to be in agreement with the previously computed results.

CR 86-09
THEORY FOR THE SCALAR ROUGHNESS AND THE SCALAR TRANSFER COEFFICIENTS OVER SNOW AND SEA ICE
Andreas, E.L.
Sep. 1986
19p.
ADA-174 089
Refs. p.17-19.
41-1263
Snow surface, Sea ice, Heat transfer, Moisture transfer, Surface roughness, Turbulent flow, Models, Wind velocity, Latent heat
The bulk aerodynamic transfer coefficients for sensible, C(H) and latent, C(E), heat over snow and sea ice surfaces are necessary for accurately modeling the surface energy budget but are very difficult to measure. This report therefore presents a theory that predicts C(H) and C(E) as functions of the wind speed and a surface roughness parameter. The crux of the model is establishing the interfacial sublayer profiles of the scalars, temperature and water vapor, over aerodynamically smooth and rough surfaces. These interfacial sublayer profiles are derived from a surface-renewal model in which turbulent eddies continually sweep down to the surface, transfer scalar contaminants across the interface by molecular diffusion, and then burst away. Matching the interfacial sublayer profiles with the usual semilogarithmic inertial sublayer profiles yields the roughness lengths for temperature and water vapor. With these and a model for the drag coefficient over snow and sea ice based on actual measurements, the transfer coefficients are predicted. C(E) is always a few percent larger than C(H). Both decrease monotonically with increasing wind speed for speeds above 1 m/s, and both increase at all wind speeds as the surface gets rougher.

CR 86-10
NATURAL ROTOR ICING ON MOUNT WASHINGTON, NEW HAMPSHIRE
Itagaki, K. et al
Sep. 1986
62p.
ADA-170 583
21 refs.
41-3480
Lemieux, G.E. Bosworth, B.W.
Aircraft icing, Propellers, Wind tunnels, Wind velocity, Unfrozen water content, Water vapor, Ice fog
Icing of a four-bladed rotor was studied under natural conditions at the top of Mt. Washington, N.H. The rotor had two cylindrical blades and two airfoil blades. The results were compared with studies conducted in icing wind tunnels. Considerable differences in icing regimes were observed. For instance, with comparable liquid water content and wind speed the wet-to-dry growth regime transition temperature was up to 10 C higher under natural conditions than in the wind tunnel studies. Results of other studies made under natural conditions were close to those of the present study, indicating that wind tunnel conditions are significantly different from natural conditions. Close examination of the conditions indicated that supersaturation of water vapor existing in most of the wind tunnel studies is the most probable cause of the differences.

CR 86-11
MORPHOLOGY, HYDRAULICS AND SEDIMENT TRANSPORT OF AN ICE-COVERED RIVER. FIELD TECHNIQUES AND INITIAL DATA
Lawson, D.E. et al
Oct. 1986
37p.
ADA-177 196
33 refs.
41-2612
Chacho, E.F. Brockett, B.E. Wuebben, J.L. Collins, C.M. Arcone, S.A. Delaney, A.J.
Icebound rivers, River flow, Ice cover effect, Sediment transport, Ice conditions, Ice cover thickness, Sampling, Water level, Frazil ice, Water temperature, Tests, Hydraulics, United States--Alaska--Tanana River
This initial study of the ice-covered Tanana River, near Fairbanks, Alaska, attempted to 1) establish field methods for systematic and repetitive quantitative analyses of an ice-covered river's regime, 2) evaluate the instruments and equipment for sampling, and 3) obtain the initial data of a long-term study of ice cover effects on the morphology, hydraulics and sediment transport of a braided river. A methodology was established, and detailed measurements and samplings, including profiling by geophysical techniques, were conducted along cross sections of the river.

CR 86-12
RESILIENT MODULUS OF FREEZE-THAW AFFECTED GRANULAR SOILS FOR PAVEMENT DESIGN AND EVALUATION. PART 2. FIELD VALIDATION TESTS AT WINCHENDON, MASSACHUSETTS, TEST SECTIONS
Johnson, T.C. et al
Oct. 1986
62p.
ADA-175 708
13 refs.
41-2613
Bentley, D.L. Cole, D.M.
Soil freezing, Bituminous concretes, Freeze thaw cycles, Pavements, Soil structure, Stresses, Design, Tests
Stress-deformation data for six granular soils ranging from sandy silt to dense-graded crushed stone were obtained from in-situ tests and laboratory tests. Surface deflections were measured in the in-situ tests, with repeated-load plate-bearing and falling-weight deflectometer equipment, when the six granular soils were frozen, thawed, and at various stages of recovery from thaw weakening. The measured deflections were used to judge the validity of procedures developed for laboratory triaxial tests to determine nonlinear resilient moduli of specimens in the frozen, thawed, and recovering states. The validity of the nonlinear resilient moduli, expressed as functions of externally applied stress and moisture tension, was confirmed by using the expressions to calculate surface deflections that were found to compare well with deflections measured in the in-situ tests. The tests on specimens at various stages of recovery are especially significant because they show a strong dependence of the resilient modulus on moisture tension, leading to the conclusion that predictions or in situ measurements of moisture tension can be used to evaluate expected seasonal variation in the resilient modulus of granular soils.

CR 86-13
RESILIENT MODULUS OF FREEZE-THAW AFFECTED GRANULAR SOILS FOR PAVEMENT DESIGN AND EVALUATION.
Johnson, T.C. et al
Oct. 1986
138p.
ADA-175 924
10 refs.
41-2549
Crowe, A. Erickson, M. Cole, D.M.
Pavements, Freeze thaw cycles, Airports, Thaw weakening, Bituminous concretes, Subgrade soils, Deformation, Roads, Surface properties, Design
Stress-deformation data for unbound base, subbase, and silty sand subgrade soils in two airfield pavements were obtained from {in situ} tests and laboratory tests. Surface deflections were measured in the {in situ} tests, with a falling-weight deflectometer, when the soils were frozen, thawed, and at various stages of recovery from thaw weakening. The measured deflections were used to judge the validity of procedures developed for laboratory triaxial tests to determine nonlinear resilient moduli of specimens in the frozen, thawed and recovering states. The validity of the nonlinear resilient moduli, expressed as functions of externally applied stress and moisture tension, was confirmed by using the expressions to calculate surface deflections that were found to compare well with deflections measured in the {in situ} tests. The tests on specimens at various stages of recovery are especially significant because they show a strong dependence of the resilient modulus on moisture tension, leading to the conclusion that predictions or {in situ} measurements of moisture tension can be used to evaluate expected seasonal variation in the resilient modulus of granular soils.

CR-86-14
EVALUATION OF SELECTED FROST-SUSCEPTIBILITY TEST METHODS
Chamberlain, E.J.
Dec. 1986
51p.
ADA-176 125
17 refs.
41-2614
Soil freezing, Frost resistance, Frost heave, Soil mechanics, Soil classification, Soil water, Freeze thaw tests
Three methods for determining the frost susceptibility of soils are evaluated in this report. These methods are the U.S. Army Corps of Engineers frost design soil classification system, a moisture-tension/hydraulic-conductivity test, and a laboratory freeze-thaw test. The Corps method, which is based on particle size, soil classification, and a laboratory freezing test, was found to be useful for identifying frost-susceptible soils. However, it cannot be used with confidence for determining the degree of frost susceptibility. The moisture-tension/hydraulic-conductivity test was found to be unacceptable because it required too much time and its results correlated poorly with field observations. The freeze-thaw test was determined to be the most accurate of the methods studied, including the freeze test that is a part of the Corps method. The freeze-thaw test is thoroughly described. It includes indexes of both frost-heave susceptibility (heave rate) and thaw-weakening susceptibility (CBR after thawing). It also accounts for the effects of freeze-thaw cycling and is completely automated to improve the repeatability of the test results. It is suggested that the freeze-thaw test be considered as a replacement for the Corps freezing test.

CR 86-16
TRIAXIAL TESTING OF FIRST-YEAR SEA ICE
Richter-Menge, J.A. et al
Dec. 1986
41p.
ADA-178 329
36 refs.
41-2547
Cox, G.F.N. Perron, N. Durell, G. Bosworth, H.W.
Ice strength, Ice mechanics, Ice crystal structure, Sea ice, Young ice, Compressive properties, Strain tests, Loads (forces), Temperature effects
This report presents the first series of conventional triaxial tests carried out on columnar first-year sea ice samples obtained from the field and tested under controlled laboratory conditions using a large-capacity test machine. A total of 110 horizontal ice samples from Prudhoe Bay, Alaska, were tested on a closed-loop electro-hydraulic test machine at -10 C in unconfined and confined constant-strain-rate compression. The confined tests were conducted in a conventional triaxial cell that maintained a constant ratio between the radial and axial stress to simulate {in situ} loading conditions. The load ratios used were 0.25, 0.50 and 0.75. The strain rate of each test was constant at 1/100, 1/1000, or 1/100,000 per sec. Data are presented on the strength, failure strain and initial tangent modulus of the first-year sea ice under these loading conditions. The effects of confining pressure, strain rate and ice structure on the mechanical properties of the ice are examined.

CR 86-17
ATMOSPHERIC ICING ON COMMUNICATION MASTS IN NEW ENGLAND
Mulherin, N.D.
Dec. 1986
46p.
ADA-178 347
34 refs.
41-3142
Antennas, Icing, Towers, Ice formation, Precipitation (meteorology), Cost analysis
Rime icing and freezing precipitation are of concern to the radio and television broadcasting industry. This report contains the results of a study seeking to document the severity and extent of transmitter tower icing and related problems in the northeastern United States. Information was obtained via mail questionnaire and telephone interviews with 85 station owners and engineers concerning 118 different stations. Results show that television and FM broadcasters are seriously impacted by tower icing; however, AM operators are usually not affected by expected New England icing levels. Combined annual costs for icing protection and icing-related repairs averaged $121, $402 and $3066 for AM, FM and TV stations respectively. None of the AM stations polled employ any icing protection measures whereas all the TV stations do. The percentage of FM stations having icing protection in the three northern states averaged 80%, indicating a significant concern for icing in that region. In contrast, the percentage of FM stations with icing protection was 63.5% for the southern New England states. The usage of guyed versus non-guyed towers was a poor indicator of icing costs. However, the factors of increasing mast height and mast top elevation are significant to increasing costs.

CR 86-18
FROST ACTION PREDICTIVE TECHNIQUES FOR ROADS AND AIRFIELDS. A COMPREHENSIVE SURVEY OF RESEARCH FINDINGS
Johnson, T.C. et al
Dec. 1986
45p.
ADA-178 243
32 refs.
41-3143
Berg, P.L. Chamberlain, E.J. Cole, D.M.
Frost heave, Roads, Airports, Freeze thaw cycles, Frost resistance, Frost penetration, Pavements, Subgrade soils, Design, Mathematical models, Frost action
Findings from a six-year field and laboratory program of frost-action research in four areas are summarized. Research on the first topic, frost-susceptibility index tests, led to selection of the Corps of Engineers frost design soil classification system as a useful method at the simplest level of testing. At a much more complex level, a new freezing test combined with a CBR test after thawing is recommended as an index of susceptibility to both frost heave and thaw weakening. Under the second topic, a soil column and dual gamma system were developed and applied to obtain soil data used in improving and validating a mathematical model of frost heave, the objective of the third topic. The model was effectively improved, a probabilistic component was added, and it was successfully tested against field and laboratory measurements of frost heave. A thaw consolidation algorithm was added, which was shown to be useful in predicting the seasonal variation in resilient modulus of granular soils, the objective of the fourth topic. A laboratory testing procedure was developed for assessing the resilient modulus of thawed soil at various stages of the recovery process, as a function of the applied stress and the soil moisture tension, which increases as the soil gradually desaturates during recovery. The procedure was validated by analyzing deflections measured on pavements by a falling-weight deflectometer. Frameworks for implementing findings from the principal research topics are outlined.

CR 87-01
RIME METEOROLOGY IN THE GREEN MOUNTAINS
Ryerson, C.C.
Jan. 1987
46p.
ADA-178 358
33 refs.
41-3144
Icing, Hoarfrost, Antennas, Ice detection, Synoptic meteorology, Meteorological factors, Mountains, Variations
Rime icing is a frequent and severe problem in higher elevations of the Green Mountains because it impacts radio and television antennas and ski lifts and could affect high elevation wind machine performance. Rime meteorology, measuring equipment performance, and variation with elevation were analyzed statistically on Mt. Mansfield and Madonna Peak, Vermont, during the winters of 1982-83 and 1983-84. Weather conditions were measured from surface weather observations, from rawinsonde 850 mb records, and from synoptic weather maps. Rime intensity with time was measured with a Rosemount antenna deicing system on Mt. Mansfield, and rime accretion was measured from collectors installed from 643 to 1227 m on the two peaks. Most rime events in the Green Mountains are of low intensity, with greatest intensities found in warmer, subfreezing air within 5 C of the dew point. Rime was usually most intense within deep low pressure systems, and was associated with 9- to 10-tenths cloud cover and light precipitation. Rime was rarely associated with high pressure. Most rime events occurred within cold and occluded fronts in southerly to westerly winds.

CR 87-02
RESILIENT MODULUS OF FREEZE-THAW EFFECTED GRANULAR SOILS FOR PAVEMENT DESIGN AND EVALUATION. PART 3. LABORATORY TESTS ON SOILS FROM ALBANY COUNTY AIRPORT
Cole, D.M. et al
Feb. 1987
36p.
ADA-179 253
6 refs.
41-2942
Bentley, D.L. Durell, G.D. Johnson, T.C.
Pavements, Freeze thaw tests, Subgrade soils, Airports, Roads, Unfrozen water content, Soil water, Temperature effects
This is the third in a series of four reports on the laboratory and field testing of a number of road and airfield subgrades, covering the laboratory repeated-load triaxial testing of five soils in the frozen and thawed states and analysis of the resulting resilient modulus measurements. The laboratory testing procedures allow simulation of the gradual increase in stiffness found in frost-susceptible soils after thawing. The resilient modulus is expressed in a nonlinear model in terms of the applied stresses, the soil moisture tension level (for unfrozen soil), the unfrozen water content (for frozen soil) and the dry density. The resilient modulus is about 10 GPa for the frozen material at temperatures in the range of -5 to -8 C. The decrease in modulus with increasing temperature was well-modeled in terms of the unfrozen water content. Upon thaw, the modulus dropped to about 100 MPa and generally increased with increasing confining stress and decreased with increasing principal stress ratio. The modulus also increased with the soil moisture tension level. The resilient Poisson's ratio did not appear to be a systematic function of any of the test variables.

CR 87-03
MECHANICAL PROPERTIES OF MULTI-YEAR SEA ICE. PHASE 1: ICE STRUCTURE ANALYSIS
Richter-Menge, J.A. et al
Mar. 1987
30p.
ADA-181 205
19 refs.
41-4143
Cox, G.F.N. Perron, N.M.
Ice mechanics, Ice structure, Sea ice, Pressure ridges, Ice floes, Tests
This report describes the structural analysis of multi-year sea ice samples that were tested in the first phase of a program designed to obtain a comprehensive understanding of the mechanical properties of multi-year sea ice from the Alaskan Beaufort Sea. Each test specimen is classified into one of three major ice texture categories: granular, columnar, or a mixture of columnar and granular ice. The crystallographic orientation, percent columnar ice, and grain size are then evaluated for the granular and/or columnar ice in the sample. Test results are interpreted with respect to these parameters. The overall composition of multi-year ridges is also considered, based on the extensive field sampling that was done in the program.

CR 87-04
CRYSTAL STRUCTURE AND SALINITY OF SEA ICE IN HEBRON FIORD AND VICINITY, LABRADOR
Gow, A.J.
Mar. 1987
18p.
ADA-180 930
15 refs.
41-4144
Ice crystal structure, Ice salinity, Sea ice, Meltwater, Ocean currents, Brines, Photography, Canada--Labrador--Hebron Fiord
Results of measurements of the crystalline structure and salinity characteristics of sea ice in Hebron Fiord and vicinity are presented. Structurally, the fiord ice was entirely first-year and composed predominantly of congelation, columnar-type crystals. At most of the sampling sites the ice exhibited moderately to strongly aligned c-axes consistent with the inferred direction of near-surface currents in the fiord. Generally diminished values of bulk salinity at five separate locations reflect the warm ice conditions encountered at the time of sampling (late May), and the effect of meltwater flushing in promoting loss of brine, vertically, from the ice sheet. Observations outside Hebron Fiord indicated the presence of only minor amounts of multiyear ice during the latter part of May.

CR 87-05
VEGETATION AND A LANDSAT-DERIVED LAND COVER MAP OF THE BEECHEY POINT QUADRANGLE, ARCTIC COASTAL PLAIN, ALASKA
Walker, D.A. et al
Apr. 1987
63p.
ADA-180 931
Refs. p.51-54.

41-4367

Acevedo, W.
Tundra, Vegetation, Geobotanical interpretation, Mapping, Remote sensing, LANDSAT, Landscapes, Patterned ground, Classifications, United States--Alaska--Beechey Point
This report presents a Landsat-derived land cover classification of the Beechey Point, Alaska, 1:250,000-scale quadrangle with descriptions of the major vegetation units. Eight Landsat-level units derived from multispectral scanner data, eleven photo-interpreted units, and eight common vegetation complexes are described and illustrated. Procedures of Landsat analysis, field methods, and cartographic methods are described. The region is divided into four landscape units: flat thaw-lake plains, gently rolling thaw-lake plains, hills, and fl[illegible] plains. Area analysis of the quadrangle was done according to townships and nine small study areas. The map uses a modified version of the hierarchical tundra mapping classification of Walker (1983). Area-measurement data from geobotanical maps at [illegible] study sites are compared with similar data from Landsat maps of the same sites. The results indicate that Landsat maps yield area measurements corresponding to broad geobotanical categories.

CR 87-06
ELECTROMAGNETIC PROPERTY TRENDS IN SEA ICE, PART 1
Kovacs, A. et al
Apr. 1987
45p.
ADA-190 929
24 refs.

41-4368

Morey, R.M. Cox, G.F.N. Valleau, N.C.
Ice electrical properties, Electromagnetic properties, Sea ice, Remote sensing, Dielectric properties, Brines, Ice salinity, Ice cover thickness, Temperature effects, Analysis (mathematics)
Two-phase dielectric mixing model results are presented showing the electromagnetic (EM) properties of sea ice versus depth. The modeled data are compared with field measurements and show comparable results. It is also shown how the model data can be used in support of impulse radar and airborne electromagnetic (AEM) remote sensing of sea ice. Examples of the remote measurement of [illegible] thickness using impulse radar operating in the 80- to 300-MHz frequency band and low-frequency ([illegible] to 30,000 Hz) sounding techniques are presented and discussed.

CR 87-07
DEVELOPMENT OF AN ANALYTICAL METHOD FOR EXPLOSIVE RESIDUES IN SOIL
Jenkins, T.F. et al
June 1987
59p.
ADA-183 73[illegible]
Refs. p.19-21.

42-20

Walsh, M.E.
Explosives, Soil pollution, Military operation, Measuring instruments, Experimentation
An analytical method was developed to determine the [illegible] TNB, DNB, [illegible], TNT and [illegible] [illegible] analytical [illegible] [illegible] [illegible] 2,4-[illegible] respectively. [illegible] of analytes [illegible] by [illegible] on an LC-CN column [illegible] methanol. Kinetic studies using naturally [illegible] soil indicated that equilibrium was achieved within 24 hr for the majority of soils and analytes studied.

CR 87-08
USE OF LANDSAT DIGITAL DATA FOR SNOW COVER MAPPING IN THE UPPER SAINT JOHN RIVER BASIN, MAINE
Merry, C.J. et al
June 1987
68p.
ADA-183 213
Refs. p.52-57.

42-21

Miller, M.S.
Snow cover distribution, Snow depth, Remote sensing, Snow water equivalent, Mapping, LANDSAT, Computer applications, Forest land
Measurements of snow depth and its water equivalent were obtained at 11 snow courses in the Allagash, Maine, area in conjunction with the acquisition of five Landsat-2 and -3 images during the 1977-78 and 1978-79 winters. To test a hypothesis that Landsat reflected radiance values on a regional scale do change, histograms of the Landsat MSS band 7 reflected radiance values for a 300 x 300 pixel (420 sq km) area near Allagash were evaluated to quantify the change. A statistical description (skewness and kurtosis) of the histogram for each scene was developed and then correlated with ground measurements of snow depth. A snow index based on skewness and modal population was found to correlate well with snow depth. Following these initial results, the Landsat data were re-examined and corrections were made for solar elevation and MSS sensor calibration. The reflected radiance from open areas showed a consistent increase in intensity with increasing snow depth. The forested land cover classes did not change with snow depth.

CR 87-09
FACTORS AFFECTING WATER MIGRATION IN FROZEN SOILS
Xu, X. et al
July 1987
16p.
ADA-184 796
20 refs.

42-463

Oliphant, J.L. Tice, A.R.
Soil water migration, Unfrozen water content, Frozen ground physics, Tests, Nuclear magnetic resonance, Temperature gradients, Water chemistry, Density (mass/volume), Temperature effects
Soil-water potential was measured on three soils and influencing factors, including water content, soil texture, dry density and temperature, were investigated. The soil-water potential in unsaturated, unfrozen soils decreases with decreasing soil water content and soil dispersion, and increases with increasing temperature and dry density. Unfrozen water contents were determined by pulsed nuclear magnetic resonance and three factors thought to affect the unfrozen water content at a given temperature were investigated. Of these three factors, only increasing the salt concentration caused a large change in the unfrozen water versus temperature curves. Water migration in an unsaturated frozen soil (Morin clay) was determined in horizontally closed soil columns under linear temperature gradients. The flux of water migration was calculated from the water distribution curves before and after testing. The flux is directly proportional to the temperature gradient and inversely proportional to the square root of the test duration, and decreases with decreasing temperature and soil dry density.

CR 87-11
DISTURBANCE AND RECOVERY OF ARCTIC ALASKAN TUNDRA TERRAIN
Walker, D.A. et al
July 1987
63p.
ADA-184 442
Refs. p.52-62.
42-334
Cate, D. Brown, J. Racine, C.
Tundra, Revegetation, Human factors, Land reclamation, Environmental impact, Pipelines, Permafrost, Roads, United States--Alaska
This document is a summary of over a decade of CRREL-managed research regarding disturbance and recovery in northern Alaska. Much of this research was sponsored by the U.S. Geological Survey's National Petroleum Reserve--Alaska exploration program and the Department of Energy's environmental research program, although numerous other agencies and members of the oil industry have also made contributions to several of the university participants. This work comes at a time of major transition in the focus of northern Alaskan environmental research from single-impact studies to analysis of cumulative impacts. Thus, it summarizes studies of anthropogenic disturbances in northern Alaska and discusses the immediate need for new methods to approach the problems of revegetation, restoration and cumulative impacts of terrain underlain by permafrost. This heritage of research comes from many research sites in northern Alaska, including Cape Thompson, the Seward Peninsula, Barrow, Fish Creek, Oumalik, East Oumalik, Prudhoe Bay, the Arctic National Wildlife Refuge and along the trans-Alaska pipeline. The impacts that are discussed include bladed trails, off-road vehicle trails, winter trails, ice roads, gravel pads and roads, borrow pits, roadside impoundments, road dust, hydrocarbon spills and seawater spills.

CR 87-12
PERSISTENCE OF CHEMICAL AGENTS ON THE WINTER BATTLEFIELD. PART 1. LITERATURE REVIEW AND THEORETICAL EVALUATION
Leggett, D.C.
Aug. 1987
20p.
ADB-115 298
Refs. p.11-14.
42-1089
Military operation, Chemical properties, Drops (liquids), Snow cover, Ice cover, Evaporation, Temperature gradients, Impurities
Literature concerning persistence of chemical warfare agents and related chemicals in cold environments is analyzed. An existing model of droplet persistence is discussed in relation to evaporation theory and practical uncertainties. This model was questioned in the case of ice and snow-covered terrain--a new model may be needed, but the necessary experimental data for testing and validation are not yet available. Experimental evaporation data for chemicals on snow are needed as well as the solubilities of ice in the relevant chemicals. Since evaporation from ice is inferred to be significantly retarded, it was emphasized that the rates of chemical degradation need to be addressed under these conditions. Hydrolysis is a mechanism of agent degradation already experimentally demonstrated in ice. More experiments are needed under conditions realistically simulating agent dissemination over snow and ice covers. Photolysis is a third potential mechanism of agent dissipation. Theoretical and indirect experimental evidence suggest that it is a wider pathway. Because thermal activation is theoretically not required, it may proceed equally rapidly at low or high temperatures. Suggestions for relevant experiments--droplet evaporation and solubility tests, and tests of hydrolysis and photolysis of droplets on ice and snow surfaces--are made.

CR 87-13
GEOCHEMISTRY OF FREEZING BRINES. LOW-TEMPERATURE PROPERTIES OF SODIUM CHLORIDE
Thurmond, V.L. et al
Aug. 1987
11p.
ADA-185 751
21 refs.
42-914
Brass, G.W.
Brines, Freezing, Geochemistry, Electrolytes, Low temperature tests, Solutions, Chemical properties, Thermodynamics, Salinity
Thermodynamic properties of electrolyte solutions change rapidly below 25 C, but these properties are seldom measured over the low temperature range (below 0 C), even though some salt solutions can remain unfrozen to -5^0 C. The heat capacities of concentrated solutions (0.5-6.0 molal) of NaCl-H2O were measured from 25 C to -40 C as part of a study to provide thermodynamic data of salt solutions for use in cold regions chemical geophysical studies. A differential scanning calorimeter was used to measure specific heat capacity from cooling scans as a function of temperature and concentration. The heat capacity data were fit to the equations of Pitzer and coworkers to obtain activity and osmotic coefficients of NaCl and H2O, respectively, below 0 C. Supercooling of the solutions was encouraged by using a fast scan rate (10 deg/minute) so that specific heat could be measured to lower temperatures than would be possible if the solutions were allowed to equilibrate with the solid phases. The solubility of ice was calculated and compared to the experimental freezing point of NaCl solutions.

CR 87-14
PHYSICAL AND STRUCTURAL CHARACTERISTICS OF WEDDELL SEA PACK ICE
Gow, A.J. et al
Aug. 1987
70p.
ADA-188 189
31 refs.
42-1950
Ackley, S.F. Buck, K.R. Golden, K.M.
Pack ice, Ice physics, Ice structure, Sea ice, Ice salinity, Drill core analysis, Frazil ice, Marine biology, Luminescence, Antarctica--Weddell Sea
During Feb. and Mar. 1980 the physical properties of Weddell Sea pack ice were investigated via core drilling of 66 floes located along a transect of 600 nautical miles from 64 S to 74 S latitude at roughly 40 W longitude. These studies revealed widespread frazil ice in amounts not known to exist in arctic sea ice of comparable age and thickness. It is estimated from structure studies of 62 of the 66 floes that 54% of the total ice production in the Weddell Sea is generated as frazil. The disposition and exceptional thicknesses of the frazil show that mechanisms other than surface turbulence effects are involved and imply that the circulation and structure of water in the upper levels of the Weddell Sea are significantly different from those in the Arctic basin. Salinities of both first-year and multi-year floes are notably higher than those of their Arctic counterparts because summer surface melting is rare or absent in the Weddell Sea; in the Arctic, downward percolating meltwater flushes through the ice and lowers its salinity. Fluorescence was evaluated as a means of revealing biological activity in Weddell Sea pack ice. It proved useful as an index of combined living and dead material in the ice, but measurements failed to establish any consistent relationship between fluorescence and salinity as suggested by earlier work in the Weddell Sea. (Auth.)

CR 87-15
TENSILE STRENGTH OF FROZEN SILT
Zhu, Y. et al
Aug. 1987
23p.
ADA-185 483
8 refs.
42-475
Carbee, D.L.
Frozen ground strength, Tensile properties, Soil physics, Strains, Sediments, Unfrozen water content
Constant strain-rate tension tests were conducted on remolded saturated frozen Fairbanks silt at various temperatures, strain rates, and densities. It was found that the critical strain rate of the ductile-brittle transition is not temperature-dependent at temperatures down to -5 C, but varies with density. The transition occurs at a strain rate of 0.01/s for medium-density silt and 0.0005/s for low-density silt. The peak tensile strength decreases considerably with decreasing strain rate for ductile failure, but it decreases slightly with increasing strain rate for brittle fracture. The failure strain remains almost constant at temperatures lower than about -2 C, but it varies with density and strain rate at -5 C. The initial tangent modulus is independent of strain rate and increases with decreasing temperature and density.

CR 87-16
PHYSICAL PROPERTIES OF SUMMER SEA ICE IN THE FRAM STRAIT, JUNE-JULY 1984
Gow, A.J. et al
Sep. 1987
81p.
ADA-186 937
39 refs.
42-1516
Tucker, W.B. Weeks, W.F.
Ice physics, Ice crystal structure, Ice floes, Snow depth, Ice salinity, Brines, Frazil ice, Ice water interface, Seasonal variations, Greenland Sea
The physical properties of sea ice in the Fram Strait region of the Greenland Sea were examined during June and July 1984 in conjunction with the MIZEX field program. Most of the ice sampled within Fram Strait during this period was multi-year; it is estimated to represent at least 84% by volume of the total ice discharged from Fram Strait during June and July. Thickness and other properties indicated that none of the multi-year ice was older than 4 to 5 years. Snow cover on the multi-year ice averaged 29 cm deep while that on first-year averaged only 8 cm. Much of this difference appears to be the result of enhanced sublimation of the snow on the thinner first-year ice. The salinity profiles of first-year ice clearly show the effects of ongoing brine drainage in that profiles from cores drilled later in the experiment were substantially less saline than earlier cores. Bulk salinities of multi-year ice are generally much lower than those of first-year ice. This difference furnished a very reliable means of distinguishing between the two ice types. Thin section examinations of crystal structure indicate that about 75% of the ice consisted of congelation ice with typically columnar type crystal structure. The remaining 25% consisted of granular ice with only a few occurrences of snow ice. The granular ice consisted primarily of frazil, found in small amounts at the top of floes, but mainly observed in multi-year ridges where it occurred as the major component of ice in interblock voids.

CR 87-17
EVALUATION OF THE MAGNETIC INDUCTION CONDUCTIVITY METHOD FOR DETECTING FRAZIL ICE DEPOSITS
Arcone, S.A. et al
Sep. 1987
12p.
ADA-186 940
13 refs.
42-1517
Brockett, B.E. Lawson, D.E. Chacho, E.F., Jr.
Ice detection, Frazil ice, Ice growth, Icebound rivers, Magnetic surveys, Subglacial observations, Water flow, Measuring instruments
The ability to map frazil ice deposits and water channels beneath an ice-covered river in central Alaska using the magnetic induction conductivity (MI) technique has been assessed. The study was performed during the first week of Mar. 1986 on the Tanana River near Fairbanks and employed a commercially available instrument operating at a fixed frequency with a fixed antenna (coil) spacing and orientation. Comparisons of the MI data with theoretical models based upon physical data measured along three cross sections of the river demonstrate the sensitivity of the MI technique to frazil ice deposits. The conductivity generally derived for the frazil ice deposits encountered is very low (about 6.3 x 1/10,000 S/m) when compared with the measured value for water (about 0.011 S/m), and is similar to the calculated values for gravel and sandy gravel bed sediments. In all three cross sections, maxima in the apparent conductivity profiles correlated with frazil ice deposits. Difficulties, possibly due to adverse effects of cold weather upon instrument calibration, affected the quantitative performance of the instrument on one cross section, although the interpretation of the data (locations of open channels vs frazil deposits) was qualitatively unaffected.

CR 87-18
AUTOMATIC FINITE ELEMENT MESH GENERATOR
Albert, M.R. et al
Sep. 1987
27p.
ADA-186 939
10 refs.
42-1518
Warren, J.L.
Heat transfer, Fluid dynamics, Computer programs, Mathematical models, Engineering
Finite element computer codes are used in a variety of fields to solve partial differential equations of importance in science and engineering. The initial input to all of these programs requires the formation of a mesh (i.e., extensive lists of geometrical data listed in particular orders), and the success of the solution depends on a well-formed mesh. This report documents a mathematical mapping technique and its implementation into a computer code that will automatically generate quality finite element meshes. This versatile generator uses standard FORTRAN, requires no special equipment (such as a digitizer), is very economical to run, and is user-friendly. The mathematical technique is discussed, advantages and limitations of the method are presented, examples are shown, and notes on user instructions are provided.

CR 87-19
APPROXIMATE SOLUTIONS OF HEAT CONDUCTION IN A MEDIUM WITH VARIABLE PROPERTIES
Yen, Y.-C.
Sep. 1987
19p.
ADA-186 933
6 refs.
42-1519
Snow physics, Heat transfer, Conduction, Analysis (mathematics), Heat balance, Thermal conductivity
The approximate heat balance integral method (HBIM) is extended to the case of a medium with variable properties such as snow. The case of linear variation of thermal conductivity is investigated. An alternative heat balance integral method (AHBIM) is developed. Both constant surface temperature and surface heat flux are considered. A comparison is made of the temperature distribution from the HBIM, AHBIM and an analytical method for the case of constant surface temperature. In general, results agree quite well with the analytical method for small values of dimensionless time {au,} but the difference becomes more pronounced as {au} increases. It is found that the AHBIM with a quadratic temperature profile gives a somewhat better result, especially when the value of the dimensionless distance is small. The results, when compared with those from HBIM, AHBIM and the analytical method are found to agree exceptionally well with the analytical method, especially for large values of {au.}

CR 87-20
MICROWAVE AND STRUCTURAL PROPERTIES OF SALINE ICE
Gow, A.J. et al
Oct. 1987
36p.
ADA-189 307
Refs. p.32-34.
42-2419
Arcone, S.A. McGrew, S.G.
Ice structure, Ice salinity, Microwaves, Ice electrical properties, Dielectric properties, Tests, Temperature effects, Brines, Models, Sea ice, Structural analysis
The structure and salinity characteristics of saline ice slabs removed from ice sheets grown in an outdoor pool have been studied and related to the complex relative dielectric permittivity measured with free-space transmission techniques at 4.80 and 9.50 GHz. The saline ice closely simulated arctic sea ice in its structural and salinity characteristics, which were regularly monitored in a number of ice sheets grown during the winters of 1983-84 and 1984-85. In-situ transmission measurements at similar frequencies were also made on the ice sheets themselves using antennas located above and beneath the ice. The slab measurements were made during warming from -29 to -2 C on slabs grown during the winter of 1983-84 (4.75 GHz) and during a warming and cooling cycle over a slightly larger temperature range on slabs grown during the winter of 1984-85 (4.80 and 9.50 GHz).

CR 87-21
SPECTRAL MEASUREMENTS IN A DISTURBED BOUNDARY LAYER OVER SNOW
Andreas, E.L.
Nov. 1987
41p.
ADA-190 217
Refs. p.37-41.
42-2637
Snow cover effect, Spectra, Boundary layer, Surface temperature, Turbulent flow, Humidity
The author measured time series of longitudinal (u)) and vertical (w))velocity and temperature (t))and humidity (q))fluctuations with fast-responding sensors in the near-neutrally stable surface layer over a snow-covered field. These series yielded individual spectra and t-w, w-q)and t-q)cospectra, phase spectra and coherence spectra for nondimensional frequencies (fz/U))from roughly 0.001 to 10. This is, thus, one of the most extensive spectral sets ever collected over a snow-covered surface. With the exception of the t-w)cospectra, all of the spectra and cospectra displayed the expected dependence on frequency in an inertial or inertial-convective subrange. All, however, contained significantly more energy at low frequency than the Kansas neutral-stability spectra and cospectra. This excess low-frequency energy and the erratic behavior of the t-w) cospectra imply that the forested hills bordering the site on two sides were producing disturbances in the flow field at scales roughly equal to the height of the hills, 100 m. The phase and coherence spectra suggest that internal gravity waves were also frequently present, since the atmospheric boundary layer generally had slightly stable stratification. Consequently, at this complex site, turbulence alone determines the spectra and cospectra at high frequency; at low frequency the spectra and cospectra reflect a combination of topographically generated turbulence and internal waves. From the measured temperature and humidity spectra and the t-q) cospectra, the author computed refractive index spectra for light of 0.55-micron and millimeter wavelengths, the first such spectra obtained over snow.

CR 87-22
THERMAL INSTABILITY AND HEAT TRANSFER CHARACTERISTICS IN WATER/ICE SYSTEMS
Yen, Y.-C.
Nov. 1987
33p.
ADA-189 627
33 refs.
42-2420
Ice water interface, Heat transfer, Meltwater, Phase transformations, Water temperature, Temperature variations, Convection, Analysis (mathematics), Density (mass/volume), Temperature distribution
This review discusses problems associated with the anomalous temperature-density relations of water. It covers a) onset of convection, b) temperature structure and natural convective heat transfer, and c) laminar forced convective heat transfer in the water/ice system. The onset of convection in a water/ice system was found to be dependent on thermal boundary conditions, not a constant value as in the classical fluids that have a monotonic temperature-density relationship. The water/ice system also exhibits a unique temperature distribution in the melt layer immediately after the critical Rayleigh number is exceeded and soon after it establishes a more or less constant temperature region progressively deepening as the melt layer grows. The constant temperature is approximately 3.2 C for water layers formed from above but varies for melt layers formed from below. The heat flux across the water/ice interface was found to be a weak power function and to increase linearly with temperature for melted layers from above and below, respectively. Both theoretical and experimental melting studies of ice spheres, cylinders, and vertical plates show a minimum heat flux in the water/ice system due to the density extremum of 4C. The inversion temperature was from 5.1 to 5.6 C. For the case of laminar forced convection melting heat transfer, the presence of an interfacial velocity (due to phase transition) reduces heat transfer in comparison with the case without phase change.

CR 87-23
AIRBORNE ELECTROMAGNETIC SOUNDING OF SEA ICE THICKNESS AND SUB-ICE BATHYMETRY
Kovacs, A. et al
Dec. 1987
40p.
ADA-188 939
21 refs.
42-2551
Valleau, N. Holladay, J.S.
Ice cover thickness, Remote sensing, Sea ice, Electromagnetic prospecting, Sounding, Subglacial observations, Airborne equipment, Analysis (mathematics)
A study was made in May 1985 to determine the feasibility of using an airborne electromagnetic sounding system for profiling sea ice thickness and the sub-ice water depth and conductivity. The study was made in the area of Prudhoe Bay, Alaska. The multifrequency airborne electromagnetic sounding system consisted of control and recording electronics and an antenna. The electronics module was installed in a helicopter, and the 7-m-long tubular antenna was towed beneath the helicopter at about 35 m above the ice surface. For this electromagnetic system, both first-year and second-year sea ice could be profiled, but the resolution of ice thickness decreased as the ice became rough. This decrease was associated with the large footprint of the system, which effectively smoothed out the sea ice relief. Under-ice water depth was determined, as was seawater conductivity. The results of the feasibility study were encouraging, and further system development is therefore warranted.

CR 88-02
FREEZING OF SOIL WITH AN UNFROZEN WATER CONTENT AND VARIABLE THERMAL PROPERTIES
Lunardini, V.J.
Mar. 1988
23p.
ADA-195 343
15 refs.

42-3911

Soil freezing, Unfrozen water content, Thermal conductivity, Phase transformations, Temperature effects, Specific heat

While many materials undergo phase change at a fixed temperature, soil systems exhibit a definite zone of phase change. The variation of unfrozen water with temperature causes a soil system to freeze or thaw over a finite temperature range. Exact and approximate solutions are given for conduction phase change of plane layers of soil with unfrozen water contents that vary linearly and quadratically with temperature. The temperature and phase change depths were found to vary significantly from those predicted for the constant-temperature or Neumann problem. The thermal conductivity and specific heat of the soil within the mushy zone varied as a function of unfrozen water content. It was found that the effect of specific heat is negligible, while the effect of variable thermal conductivity can be accounted for by a proper choice of thermal properties used in the constant-thermal-property solution.

CR 88-04
COMPOSITE BUILDINGS FOR MILITARY BASES
Flanders, S.N.
Mar. 1988
25p.
ADA-194 475
4 refs.

42-3429

Military facilities, Buildings, Safety, Cost analysis, Construction materials

This report compares the use of composite buildings with the use of conventional buildings. Composite buildings are those that combine into fewer buildings several uses that traditionally have occurred in separate buildings. The comparisons are based on construction costs, life cycle costs, speed of construction, materials availability, energy efficiency, fire safety, organizational efficiency, incremental or modular construction, and habitability. The uses reported on include a military training facility in St. Jean, Quebec; a shopping and community center complex for Fort Wainwright, Alaska; and battalion and brigade buildings for mobilization at Fort Leonard Wood, Missouri, and in Alaska. In each case, when comparisons are made between permanently constructed buildings, the composite buildings are cheaper to build and maintain than the conventional buildings. The composite buildings consume less energy and are much more convenient to their occupants.

SR 84-22
MINE DETECTION USING NON-SINUSOIDAL RADAR. PART 1: SPATIAL ANALYSIS OF LABORATORY TEST DATA
Dean, A.M., Jr. et al
Aug. 1984
99p.
ADA-150 471
3 refs.

41-462

Martinson, C.R.
Military research, Cold weather tests, Mines (Ordnance), Radar echoes, Countermeasures, Ground thawing
The interaction among UHF radiation, winter roadway conditions and buried mines was investigated in a refrigerated facility. The near-field spatial return from each target was unique. When the target was not in the near field the spatial return was not at all unique. Cobbles in the medium had little effect, but surface-thawed conditions significantly affected the spatial return, and the reflected signal strength and frequency content. The primary frequency content of the returned signal was either spread over a band broader than that of the transmitted primary frequencies, or completely outside of the primary detection band. We conclude that the complexity of winter roadway conditions requires 1) a much broader frequency band than is currently being considered, and 2) a more complex and adaptive background-removal, signal-enhancement scheme than is currently used. Further, more data are required describing the interaction of the winter media, UHF radiation, and buried mines so that adequate detection instrumentation can be developed.

SR 85-17
DETERMINING THE EFFECTIVENESS OF A NAVIGABLE ICE BOOM
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]

41-445

Ice navigation, Ice booms, River ice, Ice control, Ice cover thickness, Ice porosity
The performance of a navigable ice boom was studied by monitoring the progression of the leading edge of the unconsolidated ice cover over a reach of the St. Marys River directly downstream of the boom. Ice and hydraulic data were obtained for four winters from 1975-76 through 1978-79 for the St. Marys River at Sault Ste. Marie, Michigan. The ice cover progression rate was highest in early winter. The unconsolidated ice cover in the channel was estimated to have a thickness of at least [illegible] m and a porosity of 30%. During early winter the ice discharge per vessel passage averaged approximately 5500 cu m for the four years. Model tests for this site had indicated that without an ice control structure of any type, an ice release of 55,000 cu m per ship passage could be expected; with an ice boom the release would be 12,000 cu m per ship passage.

SR 85-21
IMPULSE RADAR SOUNDING OF LEVEL FIRST-YEAR SEA ICE FROM AN ICEBREAKER
Martinson, C.R.
Nov. 1985
[illegible]p.
ADA-163 [illegible]
[illegible] refs.

41-461

Ice cover thickness, Sea ice, Radar echoes, Sounding, Icebreakers
During the last weeks of May 1984, a CRREL impulse radar system was used onboard the RV Polarstern to measure the thickness of level first-year sea ice. The purpose was to determine the onboard performance of the radar system and, if possible, provide ice thickness information to researchers conducting other tests. Radar data were compared with ice thicknesses determined by drilling, indicating that radar soundings could be a viable means of collecting ice thickness information. A lack of adequate coordination between the two measurement methods prevented a point-by-point comparison of ice thicknesses; the comparisons were based on averages for particular test runs. The differences of the averages from the two measuring methods ranged from 0.03 m to 0.22 m with a mean variation in the differences of 0.13 m for eight runs. There may have been some interference from the ship's hull during data collection because of the location of the antenna. However, an unidentified signal in some of the data does not appear to obscure a valid return from the bottom of the ice sheet.

SR 86-03
MIZEX--A PROGRAM FOR MESOSCALE AIR-ICE-OCEAN INTERACTION EXPERIMENTS IN ARCTIC MARGINAL ICE ZONES. MIZEX BULLETIN 7
Mar. 1986
88p.
ADA-172 265
Refs. passim. For individual papers see 41-3053 through 41-3061.

41-3052

Sea ice distribution, Ice edge, Ice melting, Ice deformation, Ice crystal structure, Ice surface, Ocean currents, Ice air interface, Ice water interface, Boundary layer

SR 86-04
FORTRAN SUBROUTINES FOR ZERO-PHASE DIGITAL FREQUENCY FILTERS
Albert, D.G.
Mar. 1986
26p.
ADA-16[illegible] 355
4 refs.

41-3648

Filters, Computer programs, Design, Analysis (mathematics)
This report describes and gives user instructions for a series of FORTRAN subroutines that can be used to design and apply zero-phase frequency filters to digitized data. The general properties of these filters are discussed and complete listings are presented.

SR 86-09
MIZEX--A PROGRAM FOR MESOSCALE AIR-ICE-OCEAN INTERACTION EXPERIMENTS IN ARCTIC MARGINAL ICE ZONES. 8. A SCIENCE PLAN FOR A WINTER MARGINAL ICE ZONE EXPERIMENT IN THE FRAM STRAIT/GREENLAND SEA: 1987/89
Davidson, K. ed
Apr. 1986
5[illegible]p.
ADA-16[illegible] 070
Refs. p.45-47.

41-3930

Ice physics, Remote sensing, Ice edge, Acoustics, Meteorology, Oceanography, Ice water interface, Measuring instruments, Fram Strait, Greenland Sea

SR 86-10
REVISED GUIDELINES FOR BLASTING FLOATING ICE
Mellor, M.
May 1986
37p.
ADA-1[illegible] 750
11 refs.

41-3314

Ice blasting, Penetration tests, Floating ice, Explosion effects, Subglacial observations
Empirical prediction curves for ice blasting are given, and their derivation and use is explained. Alternative forms of the curves, which relate more closely to conventional underwater explosion technology, are developed and examined. Results of experiments with gas blasting devices are summarized and discussed in relation to the cratering effects of conventional explosives. There is a brief discussion of the energetics of ice fragmentation, effects of surface charges are outlined, and penetration by shaped charges is described. Some test data that were not previously available are given in an appendix.

SR 86-11
CONCENTRATION AND FLUX OF WIND-BLOWN SNOW
Mellor, M. et al
June 1986
16p.
ADA-170 504
7 refs.

41-3928

Fellers, G.
Snowdrifts, Snow removal, Wind tunnels, Visibility, Wind velocity, Mass transfer, Statistical analysis
Representative graphical relations are developed for the flux and concentration of wind-blown snow as functions of wind speed and height above surface. Previously published field data are tabulated to provide 1201 data sets for flux and the same number for mass concentration. Using appropriately transformed variables, multiple regression analysis yields empirical relations for horizontal mass flux as a function of wind speed and height, and for mass concentration as a function of wind speed and height.

SR 86-12
NATURAL ELECTRICAL POTENTIALS THAT ARISE WHEN SOILS FREEZE
Yarkin, I.G.
June 1986
24p.
ADA-170 583
16 refs.
41-3929
Soil freezing, Electrical properties, Frost heave, Soil structure, Experimentation, Polarization (charge separation)
Samples of sand, kaolin, bentonite, and loam were frozen from the top downward in cylinders 10 to 12 cm high and 7 cm in diameter. During the freezing process electrical potentials of up to [illegible] mV were measured between platinum electrodes placed near the ends of the samples. The mechanism that gives rise to these potentials and the effect of soil type and fineness, moisture content, and moisture migration are discussed.

SR 86-13
DESCRIPTION OF THE BUILDING MATERIALS DATA BASE FOR PORTLAND, MAINE
Merry, C.J. et al
June 1986
33p.
ADA-172 [illegible]
12 refs.
41-662
LaPotin, P.J.
Construction materials, Precipitation (meteorology), Chemical analysis, Environmental protection, Buildings, Damage, Statistical analysis, Computer applications, United States--Maine--Portland
A building materials sampling program for the Portland, Maine, region was conducted in July and August 1984 to examine the types and amounts of building surface materials exposed to acid deposition. The stratified, systematic, unaligned random sampling approach was used to generate sample points across the six sampling frame areas. A minimum of 70 sample points was examined per sampling frame to yield a total sample size of 461 points. Building sizes, surface materials, roof characteristics, roof-mounted apparatus, chimneys, gutters, downspouts and fences were recorded. This report provides an initial summary of the data collected.

SR 86-14
ICE HEAT SINKS. PART 1: VERTICAL SYSTEMS
[illegible], V.J.
June 1986
[illegible]
AD[illegible]
Refs. p.40-42.
41-3815
Military operation, Ice heat flux, Heat sinks, Heat transfer, Thermal properties, Mathematical models, Design, Computer applications, Ice melting, Water temperature
A review is presented of the general characteristics of ice heat sinks, including thermal, mechanical and operational aspects. The thermal design of a vertical ice heat sink with annular flow is outlined using a computer model to give quantitative results. The mathematical model allows interaction between the ice sink and the surrounding rock material. Design curves are presented to estimate the outlet water temperature as a function of time and the rate of ice melt.

SR 86-15
BLASTING AND BLAST EFFECTS IN COLD REGIONS. PART 2: UNDERWATER EXPLOSIONS
Mellor, M.
July 1986
[illegible]
ADA 174 [illegible]
For Pt.1 see 40-3304. 17 refs.
41-3020
Ice blasting, Explosion effects, Shock waves, Ice sheets, Subglacial observations, Cold weather performance, Military operation
The general characteristics of underwater explosions are reviewed in order to provide a background for the consideration of under-ice explosions. Test data for under-ice explosions and for explosive ice-breaking are summarized and interpreted.

SR 86-17
ARCTIC AND SUBARCTIC CONSTRUCTION: GENERAL PROVISIONS
Lobacz, E.F.
July 1986
75p.
ADA-172 674
Refs. p.72-75.
41-663
Cold weather construction, Frost action, Permafrost distribution, Frost penetration, Freezing indexes, Ground thawing, Snow cover distribution, Polar regions
Working in the world's cold regions is quite different from working in warmer places. This document gives general information on frost action, permafrost and other special factors to help engineers who must operate in arctic and subarctic areas.

SR 86-18
SOME DEVELOPMENTS IN SHAPED CHARGE TECHNOLOGY
Mellor, M.
July 1986
29p.
ADB-109 557
15 refs. For another source see 41-2675.
41-3049
Projectile penetration, Cavitation, Frozen ground strength, Ice strength, Military operation, Materials, Penetration tests, Design

SR 86-19
EFFECT OF FREEZING ON THE LEVEL OF CONTAMINANTS IN UNCONTROLLED HAZARDOUS WASTE SITES. PART 1: LITERATURE REVIEW
Iskandar, I.K.
July 1986
33p.
ADA-172 979
Refs. p.27-33.
41-693
Waste treatment, Pollution, Soil freezing, Water treatment, Sea water, Sludges, Freeze thaw cycles, Ions, Artificial freezing
This report reviews the literature concerning the effects of ground freezing on uncontrolled hazardous waste sites. Since there was very little information directly related to hazardous waste materials, previous studies on the beneficial use and impact of freezing on wastewater, sea water, sludges and soils have been included. Freezing of uncontrolled hazardous waste sites may cause frost heaving of buried waste material, allowing chemical wastes to move upward, and chemical transport of ions in freezing and frozen soils. Also, repeated cycles of freeze-thaw may adversely affect the durability of clay liners being used to cover hazardous waste sites. Ground freezing can be used beneficially to 1) dewater and consolidate hazardous waste materials, particularly slurry-type wastes; 2) serve as an alternative to slurry walls, trenches, etc., to separate contaminated areas; and 3) immobilize the contaminants, particularly if time is a critical factor.

SR 86-20
INITIAL ASSESSMENT OF THE 600-GALLON-PER-HOUR REVERSE OSMOSIS WATER PURIFICATION UNIT. FIELD WATER SUPPLY ON THE WINTER BATTLEFIELD
Bouzoun, J.R. et al
July 1986
6p.
ADA-171 [illegible]
3 refs.
41-529
Reed, S.C. Diener, C.J.
Water supply, Military facilities, Water treatment, Cold weather performance, Water pollution, Logistics, Water temperature
An initial study was conducted to determine the effects of raw water temperature on the finished water production rates of the Army's new 600-gal./hr Reverse Osmosis Water Purification Unit (ROWPU). This study showed that the finished water production rates decreased from 597 gal./hr at a raw water temperature of 68.3 F to 349 gal./hr at a raw water temperature of 33.7 F. The report also has a list of suggestions on how to set up and operate the ROWPU on the winter battlefield.

SR 85-21
STABILIZATION OF FINE-GRAINED SOIL FOR ROAD AND AIRFIELD CONSTRUCTION
Danyluk, L.S.
July 1986
37p.
ADA-172 600
14 refs.

41-540

Soil stabilization, Roads, Frost resistance, Bitumens, Cement admixtures, Subgrade soils, Grain size, Liming, Chemical properties, Organic soils, Frost heave, Airports

A laboratory study was conducted to determine the feasibility of stabilizing an organic silt for use in sub-base or base courses for all-weather, low-volume roads and airfields in Alaska. The soil used in this study has an organic content of 12% and a modified Proctor value of 79.1 lb/cu ft at a 29% moisture content. The stabilizers evaluated were: cement, cement with additives (calcium chloride, hydrogen peroxide, sodium sulfate, and lime), lime, lime/fly ash, asphalt emulsion, tetrasodium polyphosphate, and calcium acrylate. Unconfined compressive strengths obtained were: 59 lb/sq in. with 20% cement, 64 lb/sq in. with 20% cement and 2% calcium chloride, 51 lb/sq in. with asphalt emulsion, and 345 lb/sq in. with calcium chloride. Lime and lime/fly ash proved to be ineffective for this soil. Although tetrasodium polyphosphate did not improve the soil's strength it did reduce frost susceptibility and permeability.

SR 85-22
AFTER-ACTION REPORT--REFORGER '85
Liston, R.A.
Aug. 1986
20p.
ADB-107 244

41-3815

Military operation, Tanks (combat vehicles), Tires, Snow cover effect, Soil water, Trafficability, Snowfall

Four demonstrations associated with the 1985 REFORGER are described: a demonstration of the performance characteristics of commercially available radial tires, a demonstration of the use of a soil moisture sensor to predict the trafficability of soils in a maneuver area, a demonstration of the need to account for the effects of a snow cover when planning anti-tank and anti-personnel mine fields, and a determination of the effects of the winter environment on tank electro/optical systems performance.

SR 85-23
ICE ATLAS, 1984-1985: OHIO RIVER, ALLEGHENY RIVER, MONONGAHELA RIVER
[illegible], L.W., et al
[illegible]
[illegible]

42-801

[illegible]

Ice conditions on inland rivers can change rapidly and adversely affect navigation. The ice maps in this atlas were prepared to document the 1984-85 ice conditions on those reaches of the Ohio, Allegheny and Monongahela Rivers that are included in study areas for the River Ice Management (RIM) Program, namely river mile 0 to 437 on the Ohio River, mile 0 to 7 on the Allegheny, and mile 0 to 56 on the Monongahela. The maps were prepared from interpretation of vertical aerial video imagery taken from a low-flying aircraft. The interpreted ice conditions were classified into 5 units, and transferred to base maps by reference to navigation charts and topographic maps. Fragmented Ice Cover and Ice Floes or Frazil Slush and Pans were the most common ice units in the lower pools of the Monongahela River and lower Allegheny. Solid Ice Cover and Fragmented Ice Cover were the most common units in the upper pools of the Monongahela. Fragmented Ice Cover and Open Water were the most extensive units in the Emsworth to New Cumberland pools of the Ohio; Open Water and Ice Floes or Frazil Slush and Pans were the predominant units in the downstream pools. There were frequent cancellations of flights during the 1984-85 winter because of low cloud ceilings. To get more frequent video coverage of ice during the 1985-86 winter, a wider-angle lens on the video camera will be used. This will allow flights at a lower altitude, permitting video coverage even when the ceiling is low.

SR 86-24
CONDENSING STEAM TUNNEL HEAT SINKS
Lunardini, V.J.
Aug. 1986
29p.
ADB-106 677
19 refs.

41-1350

Heat sinks, Tunnels, Heat transfer, Rocks, Thermodynamics, Condensation, Thermal conductivity, Mathematical models, Temperature effects, Air masses

This report examines the feasibility of condensing steam from an underground power source by heat conduction into the surrounding rocks. A mathematical model was utilized such that the condensing steam delivered a variable flux of energy to the walls of the condenser tunnel. Heat flow in the surrounding rock was limited to conduction. A numerical analysis of the transient problem results in predictions of tunnel lengths and diameters needed to dissipate specified condenser heat loads as a function of initial steam pressure, surrounding rock thermal properties, and ambient rock temperature. The rock thermal conductivity exerts a large influence upon the required tunnel length, with tunnel length decreasing with increasing rock conductivity. The quantitative predictions of the model indicate that a condensing steam tunnel in rock may be competitive with circulating water or air/water heat dissipation modes.

SR 86-25
WINTER FIELD FORTIFICATIONS
Farrell, D.
Aug. 1986
50p.
ADB-106 228
23 refs.

41-3817

Fortifications, Military operation, Snow (construction material), Wooden structures, Embankments, Winter, Tests

Preparation of winter field fortifications poses problems that are not encountered in any other environment. The primary construction materials available for aboveground construction are snow and wood. This report describes what snow is, and how and when to use it to the best advantage; and it presents the results of tests of the capacity of snow embankments to stop projectiles. The information presented is based on both laboratory and field test results. Both approaches were required to understand why a bullet stops quickly in snow and how durable a snow fortification can be. Field tests showed that a non-fuzed round as large as that from the Soviet 14.5 mm KPV can be stopped by 2 m (6.6 ft) of packed snow. Laboratory studies revealed the mechanics of bullet interaction with snow. For the larger, fragmentation munitions field tests were cumbersome and unproductive. But a laboratory simulation of fragment penetration into snow showed that only 0.6 m (2 ft) of packed snow stops the smaller, high-velocity fragments while 1.5 m (5 ft) of snow is required to stop the larger, slower fragments. To represent the larger, anti-armor, direct-fire weapons containing shaped-charge warheads, the 90-mm M67 and the 73-mm Soviet RPG-7 were used in field tests. The results showed that 3 m (10 ft) of snow stopped all effects, even after multiple impacts.

SR 86-26
ICE HEAT SINKS. PART 2: HORIZONTAL SYSTEMS
Lunardini, V.J.
Aug. 1986
104p.
ADB-111 755
Refs. p.23-25.
41-3818

Military operation, Heat sinks, Ice heat flux, Heat transfer, Computer applications, Mathematical models, Thermal properties, Ice melting, Water temperature
The thermal design of a horizontal ice heat sink with horizontal water flow is outlined using a computer model to give quantitative results. The mathematical model allows interaction between the ice sink and the surrounding rock material. Data taken from an experiment, undertaken as part of this study, on melting, horizontal ice sheets were used in the mathematical model. Design curves are presented to estimate the outlet water temperature as a function of time and the rate of ice melt. The horizontal ice heat sinks can deliver outlet water at temperatures between 45 and 55 F for a considerable period of time (hundreds of hours) if the heat dissipation rate of the sink is less than 0.8 kW/ft. For this range of heat dissipation rates, the horizontal sink is comparable in performance to the vertical ice heat sink. The mathematical model emphasizes the thermal aspects of the heat sink with no consideration given to mechanical and plumbing problems, construction techniques, or maintenance of the sink.

SR 86-27
DRILL BITS FOR FROZEN FINE-GRAINED SOILS
Sellmann, P.V. et al
Aug. 1986
33p.
ADA-173 113
9 refs.
41-2610

Mellor, M.
Drills, Frozen ground temperature, Augers, Permafrost, Sediments, Grain size, Ground ice, Rotary drilling, Temperature effects
Successful drill bits for use in frozen sediments have certain characteristics that are not commonly found in commercial bits used for unfrozen soils and rocks. In frozen sediments, drilling characteristics and optimum bit design vary, depending on grain size, ice content, and temperature of the material. Drills for frozen fine-grained material (silt and clay) have specific requirements that differ from those for other frozen soil types. Important features of drills that perform well in frozen fine-grained materials include: (1) full face cutting, (2) a pilot bit that can cut and clear its cuttings, (3) appropriate cutter angles (adequate clearance angles and positive rake), (4) sharp but durable cutters, (5) unobstructed flow paths for chip clearing, and (6) stabilizing features for smooth running. Examples of successful bits are discussed and illustrated. Some were built or modified at CRREL, while others are of commercial manufacture.

SR 86-28
ENGINEERING SURVEYS ALONG THE TRANS-ALASKA PIPELINE
Godfrey, R.N. et al
Sep. 1986
55p.
ADA-173 353
4 refs.
41-799

Eaton, R.A.
Permafrost beneath structures, Cold weather construction, Pipelines, Freeze thaw cycles, Engineering, Permafrost beneath roads, Design criteria, Environmental protection, Climatic factors, Thaw depth, United States--Alaska
During the spring of 1976, environmental engineering investigations along the Alyeska Pipeline Haul Road and TAPS (Trans-Alaska Pipeline System) Road were initiated by CRREL in conjunction with the Federal Highway Administration and the Alaska Department of Highways. The three-year research project had two general objectives: 1) to systematically obtain data on selected highway, airfield and pipeline workpad test sites and adjacent terrain to establish the rates and types of modifications in permafrost-dominated regions, and 2) to provide the basis for improved design criteria and specifications governing road, airfield and workpad construction and restoration in permafrost zones that are influenced by many different seasonal climatic regimes.

SR 86-29
BLISTERING OF BUILT-UP ROOF MEMBRANES: PRESSURE MEASUREMENTS
Korhonen, C.
Oct. 1986
22p.
ADA-190 293
13 refs.
42-2672

Roofs, Surface temperature, Protective coatings, Maintenance, Pressure, Damage, Temperature measurement
Several blisters in built-up roof membranes were instrumented with pressure and temperature sensors. Internal blister pressures varied from positive during the heat of the day to negative during the cool of the night; these pressure changes cause blisters to grow. Air is drawn into the blister at night. When exposed to sunshine, the air rapidly expands before it can escape. Water is not necessary to cause growth. Blisters grow best when the days are hot and the nights are cool. Pressures apparently do not occur within the insulated space of a roof to cause blisters. Reflective coatings may help to slow blister growth. Growth can be stopped by using a miniature pressure relief valve.

SR 86-30
SECOND WORKSHOP ON ICE PENETRATION TECHNOLOGY, 1986
Workshop on Ice Penetration Technology, 2nd, Monterey, CA, June 16-19, 1986
Oct. 1986
659p.
ADB-108 529
Refs. passim. For individual papers see 41-2653 through 41-2681.
41-2652

Ice cover strength, Penetration tests, Military operation, Sea ice, Ice mechanics, Meetings, Design, Ice cover thickness, Models, Cavitation
On 16-19 June 1986 the Naval Surface Weapons Center (NSWC) and the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) co-hosted the Second Workshop on Ice Penetration Technology at the Naval Postgraduate School in Monterey, California. Since the first workshop at CRREL two years ago, many notable accomplishments had occurred regarding ice penetration and related subjects. The objectives of the workshop were to provide a forum at which to present and discuss these findings and identify areas requiring more work. Papers were presented on the following general topics: environmental data needs, ice measurement techniques, ice statistics, ice mechanics, scale model tests, field tests, analytical modeling, design and hardware, alternate methods, airborne ASW and submarines.

SR 86-31
DESCRIPTION OF THE BUILDING MATERIALS DATA BASE FOR CINCINNATI, OHIO
Merry, C.J. et al
Oct. 1986
85p.
ADA-189 046
14 refs.
41-3498

LaPotin, P.J.
Construction materials, Precipitation (meteorology), Environmental protection, Damage, Chemical analysis, Statistical analysis, Computer programs, Sampling
A building materials sampling program for the Cincinnati, Ohio, region was conducted in Jan. and Feb. 1985 to examine the types and amounts of building surface materials exposed to acid deposition. The stratified, systematic, unaligned random sampling approach was used to generate sample points across four sampling frame areas. A minimum of 70 sample points was examined per sampling frame to yield a total sample size of 387 points. Building sizes, surface materials, roof characteristics, roof-mounted apparatus, chimneys, gutters, downspouts and fences were recorded. This report provides an initial summary of the data collected.

SR 86-32
EQUIPMENT FOR MAKING ACCESS HOLES THROUGH ARCTIC SEA ICE
Mellor, M.
Nov. 1986
34p.
ADA-180 961
34 refs.

41-3819

Ice openings, Ice drills, Projectile penetration, Sea ice, Hydraulic jets, Ice blasting, Equipment, Rotary drilling, Percussion drilling, Ice cutting
Navy underwater construction teams require a capability for making access holes through arctic sea ice. Required hole diameters range from less than 4 in. (100 mm) to more than 10 ft (3 m) in ice up to 15 ft (4.5 m) thick. Small diameter holes are to be completed in less than 4 hr and large diameter holes in less than 8 hr. The report first gives brief descriptions of the working environment, site access considerations, and probable operational procedure. Principles and techniques for penetrating sea ice are summarized, with an initial list of 14 topics. Twelve of these items are identified as potentially relevant, and are discussed more fully. They include: 1) projectile penetration, 2) shaped charge penetration, 3) high pressure water jets, 4) blasting, 5) flame jets, 6) electrothermal devices, 7) hydrothermal devices, 8) rotary drilling, 9) percussive and vibratory penetration, 10) mechanical cutting, 11) chemical penetration, 12) exotic concepts. The final selection, which takes into account practical concerns and field experience, recommends the following things as basic tools: a) small diameter auger drills (less than 4 in. diam), b) large diameter auger drills (approx. 9 in. diam), c) chain saws, d) a hot water system for drilling and cutting. The discussion of associated equipment covers electric generators, hoists and lifting tackle, hand tools, and blasting supplies. Consideration is also given to single-fuel operation, bulk melting, and possibilities for use of compressed air. Recommendations for development work by NCEL are given.

SR 86-33
INSTRUCTIONS FOR COMPLETING A FIELD WORKSHEET FOR INVENTORYING BUILDING MATERIALS
Merry, C.J.
Dec. 1986
25p.
ADA-175 467
4 refs.

41-2530

Construction materials, Precipitation (meteorology), Environmental protection, Damage, Chemical analysis
A worksheet for use in the field was developed to inventory building materials in four northeastern cities in support of the EPA Acid Rain program. The initial form was tested for two of the cities; the redesigned and simplified form discussed in this report was used in the two remaining cities. The worksheet was designed to provide information on the census tract, land use type and sampling frame; the dimensions and type of building; the lot size; the materials distribution percentages in the foundation, first story and all above stories; and the surface area and material types for the roof, roof-mounted apparatus (vents, flues, stacks, skylights and flashing), chimneys, rain gutters, downspouts and fences. The worksheet is recommended for future surveys of building materials in other cities.

SR 86-34
CALIBRATING HEC-2 IN A SHALLOW, ICE-COVERED RIVER
Calkins, D.J. et al
Dec. 1986
25 refs.
ADA-176 485
7 refs.

41-2531

Adley, M.D.
Flood control, Icebound rivers, Ice cover thickness, River flow, Water level, Mathematical models, Floating ice, Freezeup, Ice cover effect
HEC-2 has recently been modified to accept input for a floating ice cover. Several techniques were evaluated in calibrating the model versus the measured field data for a steep, shallow river. The ice cover thickness, as expected, was the dominant parameter affecting the water levels and not the Manning's roughness coefficient of the ice cover. Excellent field data on ice cover thicknesses, water levels and flow discharges were available for calibration. The relatively shallow depths of less than 5 ft and ice covers of up to 3-ft thick created special problems in matching the water levels. The actual ice cover thicknesses measured in the field should be used as a guide for ice thickness input to the model for shallow streams. The transition of ice cover thickness from one section to the next in the model is extremely critical, otherwise there will be excessive head losses. Several methods for interpolating the ice thickness between the measured sections were attempted in trying to simulate the freeze-up, and ineffective flow areas were blocked off as well. The latter provided the most realistic simulation of flow velocities beneath the ice cover.

SR 86-35
ROOF BLISTERS. PHYSICAL FITNESS BUILDING, FORT LEE, VIRGINIA
Korhonen, C. et al
Dec. 1986
15p.
ADA-177 801
3 refs.

41-2611

Bayer, J.
Roofs, Waterproofing, Thermal properties, Leakage, Buildings, Defects, Countermeasures
The blisters on this 2-year old roof were first noticed one year after construction. Findings show that all blisters were built into the roof and that they will continue to develop in size and number. Currently, this roof is watertight, but leaks will occur as blisters begin to break. Rather than wait for problems, recommendations are provided for using a CRREL-designed pressure relief valve to prevent blisters from growing and ever becoming a problem.

SR 86-36
AUGER BIT FOR FROZEN FINE-GRAINED SOIL
Sellmann, P.V. et al
Dec. 1986
13p.
ADA-180 343
5 refs.

42-2673

Brockett, B.E.
Augers, Frozen ground strength, Drills, Military engineering, Penetration tests, Boreholes
Auger bits 6.5 in. (165 mm) and 9.5 in. (241 mm) in diameter were modified to satisfy military and general engineering requirements for producing holes in frozen soil. A commercial bit was selected since it appeared to need only minor modification. Penetration tests were run in frozen fine-grained soils, one type containing some gravel. Modifications, which primarily involve changes in cutter relief angles, substantially improved performance. Penetration rates were as high as 5 ft/min (1.5 m/min), compared to 0-1.4 ft/min (0-0.4 m/min) for the unmodified bits.

SR 86-37
DEVELOPMENT OF A FRAZIL ICE SAMPLER
Brockett, B.E. et al
Dec. 1986
12p.
ADA-179 043

41-3257

Sellmann, P.V.
Frazil ice, Core samplers, Ice sampling, Design, Grain size
A lightweight sampler has been constructed to provide large cores from frazil ice deposits. Samples containing frazil ice particles ranging in size from 1 mm to over 70 mm, including the interstitial water, were successfully recovered during field tests. These samples were nearly undisturbed while confined in the sample tube, based on a comparison with samples acquired using a freeze probe technique.

SR 86-38
LOW TEMPERATURE EFFECTS ON SORPTION, HYDROLYSIS AND PHOTOLYSIS OF ORGANOPHOSPHONATES--A LITERATURE REVIEW
Britton, K.B.
Dec. 1986
47 refs.
ADA-178 349
Refs. p.42-47.

41-3050

Pollution, Chemical analysis, Ice composition, Snow composition, Pesticides, Soil composition, Frozen ground, Temperature effects, Environmental impact
A survey was made of the open literature to determine the information available on the persistence of organophosphonate chemical agents in the environment. This review focuses on low temperature hydrolytic and photolytic degradation of the nerve agents GA (Tabun), GB (Sarin), GD (Soman) and VX. The role of adsorption to ice, snow and frozen soils and sediments is also discussed in relation to these degradative processes. Suggestions are made for the investigation of agent decomposition using simulants. The method proposed for the study of agent persistence is based on the use of linear free energy relationships, which should allow for more reliable prediction of agent behavior than if a single simulant is used as a model compound.

SR 86-39
COMPARATIVE TRACTIVE PERFORMANCE OF MICROSIPED AND CONVENTIONAL RADIAL TIRE DESIGNS
Blaisdell, G.L. et al
Dec. 1986
11p.
ADA-178 355
4 refs.

41-3051

Morrison, R.L.
Tires, Traction, Rubber ice friction, Brakes (motion arresters), Design
The braking and driving tractive effectiveness of aftermarket microsiping of all-season design radial tires was studied as an alternative to standard traction aids such as snow tires, studs, and chains. Microsiping is a process that involves laterally slicing the tires to a depth close to that of the tread depth, thus dividing each tread element into several adjacent, contacting elements. Microsiping removes virtually no material from the tire. From previous studies, it is known that traction on ice is overwhelmingly dependent on the adhesion between the ice surface and the tire tread compound. Since microsiping does not alter the compound, a measurable improvement in traction on ice for several tire types and temperatures, as expected, was not found.

SR 87-02
LOSSES OF EXPLOSIVES RESIDUES ON DISPOSABLE MEMBRANE FILTERS
Jenkins, T.F. et al
Mar. 1987
25p.
ADA-180 889
10 refs.

41-3820

Knapp, L.K. Walsh, M.E.
Explosives, Pollution, Filters, Laboratory techniques, Experimentation, Water pollution, Solutions
A number of 0.45-micron disposable filters were tested for sorption of HMX, RDX, TNB, DNB, tetryl, TNT and 2,4-DNT. Both aqueous and mixed aqueous-organic solvent matrices were tested. For aqueous matrices, the Nalgene (green) cellulose acetate filter sorbed significant amounts of HMX, RDX, TNT and 2,4-DNT. The Gelman Acro LC25 filter, described as a naturally hydrophilic fluoropolymer, also sorbed significant levels of HMX, TNT and tetryl. Where sorption was found, losses were greatest for the first portion of filtrate passed through the filter and for filtration conducted slowly. Addition of 50% organic solvent prior to filtration eliminated sorption problems for all filters tested. When aqueous matrices are filtered, the recommended procedure is to discard the first 10-mL portion of filtrate and retain the second 10-mL portion for analysis.

SR 87-04
EXTINCTION COEFFICIENT MEASUREMENT IN FALLING SNOW WITH A FORWARD SCATTER METER
Koh, G.
Mar. 1987
9p.
ADA-180 958
5 refs.

41-3349

Light scattering, Snowfall, Infrared radiation, Light transmission, Fog, Military operation
A forward scatter meter designed to measure the visible extinction coefficients measured with a forward scatter meter and a transmissometer indicates that a forward scatter meter can be used to measure extinction coefficient in falling snow. The different calibrations required for snow and fog are partially explained by examining the effect of particle size on the angular distribution of scattered light.

SR 87-05
TREATMENT AND DISPOSAL OF ALUM AND OTHER METALLIC HYDROXIDE SLUDGES
Reed, S.C. et al
Mar. 1987
40p. + plates
ADA-180 960
19 refs.

41-4142

Smith, J.E. Sletten, R.S. Kesta, J.
Sludges, Water treatment, Waste treatment, Waste disposal, Freezing, Drying, Military facilities, Mass balance
Sludge is an inevitable product of water and wastewater treatment. The treatment and disposal of these materials is often the most costly aspect of the overall operation. The use of alum and other metallic chemicals for coagulation and other purposes has increased significantly in both water and wastewater treatment in recent years. These chemicals not only increase the total volume of sludge produced but very significantly influence its characteristics. This report describes a number of processes for sludge treatment and disposal and recommends those best suited for military facilities.

SR 87-06
PROCEDURE FOR MEASURING BUILDING R-VALUES WITH THERMOGRAPHY AND HEAT FLUX SENSORS
Flanders, S.N.
May 1987
29p.
ADA-180 959
5 refs.

41-4383

Thermal insulation, Buildings, Heat flux, Economic analysis, Computer applications, Infrared equipment, Measuring instruments, Tests
This report describes a procedure for measuring R-values on actual buildings, using thermography, heat flux transducers, and data acquisition equipment. R-values measurement is necessary to optimize investment in additional insulation and permits confirmation of the quality of newly installed insulation.

SR 87-07

PREPARATION AND DESCRIPTION OF A RESEARCH GEOPHYSICAL BOREHOLE SITE CONTAINING MASSIVE GROUND ICE NEAR FAIRBANKS, ALASKA

Delaney, A.J.
June 1987
15p.
ADA-183 186
4 refs.

41-3627

Permafrost physics, Ground ice, Boreholes, Geophysical surveys, Soil temperature, United States--Alaska--Fairbanks

A geophysical control site consisting of 27 holes drilled in permafrost and cased with ABS pipe has been completed near the USACRREL permafrost tunnel at Fox, Alaska. The site provides excellent control on a range of material types in permafrost terrain including frozen silt, gravel, bedrock, and all common ground-ice types such as wedge, lens, and pore ice. The holes delineate massive ground-ice features of which there is no surface manifestation. Ground temperature data is available from a small-diameter glycol-filled hole. This report describes the site, its preparation, and the soil logs and data obtained.

SR 87-09

NODAL DOMAIN INTEGRATION MODEL OF TWO-DIMENSIONAL HEAT AND SOIL-WATER FLOW COUPLED BY SOIL-WATER PHASE CHANGE

Hromadka, T.V., II
June 1987
124p.
ADA-183 518
Refs. passim.

41-1568

Frozen ground thermodynamics, Soil water migration, Heat transfer, Freeze thaw cycles, Heat flux, Phase transformations, Mathematical models, Computer applications, Temperature effects, Snow cover effect

A model of phase change in freezing and thawing soils is developed for cold regions engineering problems which require two-dimensional analysis of the thermal regime of soils. These problems include complex boundary conditions such as atmosphere/ground surface thermal interaction and snowpack insulation. Other concerns include complex soil conditions such as the presence of a peaty muskeg or tundra-like soil which may provide thermal insulation for underlying ice-rich mineral soil. Although several models have been developed to predict temperatures in freezing and thawing soils, often the key question is simply whether or not the soil is frozen, since soil structural properties are significantly influenced by the soil-water state of phase. In this report, a simple two-dimensional model is developed for use in cold regions engineering studies. A FORTRAN computer program is available which accommodates two-dimensional heat and soil-water flow models as coupled by an isothermal phase change model. The program can be used to analyze two-dimensional freezing-thawing problems which have sufficient known information to supply the necessary modeling parameters, boundary conditions, and initial conditions.

SR 87-1

FREEZE-THAW TEST TO DETERMINE THE FROST SUSCEPTIBILITY OF SOILS

Chamberlain, E.J.
Jan. 1987
90p.
ADA-180 000
7 refs.

41-3258

Freeze thaw tests, Pavements, Frost heave, Frost resistance, Airports, Soil freezing, Thaw weakening, Aircraft landing areas

A new freezing test for determining the frost susceptibility of soils is presented to supplant the standard CRREL freezing test currently specified by the Corps of Engineers. This test reduces the time required to determine the frost susceptibility of a soil in half. It also allows for the determination of both the frost heave and thaw weakening susceptibilities and considers the effects of freeze-thaw cycling. The new freezing test eliminates much of the variability in test results caused by the human element by completely automating the temperature control and data observations.

SR 87-10

BENCHMARK DESIGN AND INSTALLATION: A SYNTHESIS OF EXISTING INFORMATION

Gatto, L.W.
July 1987
73p.
ADA-183 925
27 refs.

42-92

Bench marks, Cold weather construction, Frost heave, Stability, Subsidence, Design, Surveys

Techniques used for topographic, hydrographic, construction, boundary, geodetic and structural movement surveys are only as accurate as the benchmarks used as reference. In northern areas, frost action can cause substantial vertical movement of benchmarks. Benchmarks may also subside or shift in wetlands and coastal areas. Various benchmark designs and installation procedures reduce or eliminate movement, but information on the designs and procedures is widely scattered and not available to Corps of Engineers Districts in one report. This report is a synthesis of information compiled from surveys of Corps of Engineers Districts and Divisions, U.S. and Canadian government agencies, private industry and a literature review. Matrices for selecting and installing benchmarks that meet third-order accuracy requirements or better and that are appropriate for various climatic and soil conditions were prepared from the synthesized information. Procedures to be followed while installing various types of benchmarks are included.

SR 87-11

EMBANKMENT DAMS ON PERMAFROST: DESIGN AND PERFORMANCE SUMMARY, BIBLIOGRAPHY AND AN ANNOTATED BIBLIOGRAPHY

Sayles, F.H.
July 1987
109p.
ADA-184 153
Refs. p.28-102.

42-106

Permafrost beneath structures, Dams, Embankments, Seepage, Cold weather construction, Design, Deformation, Ponds, Spillways, Freeze thaw cycles

The designs of embankment dams on permafrost can be divided into two general types, frozen and thawed. The frozen type of embankments and their foundations are maintained frozen during the life of the structure. The thawed type of embankments usually are designed assuming that the embankment will remain unfrozen and its permafrost foundation will thaw during construction or during the operation of the structure. In some locations where water is to be retained intermittently for short periods of time, thawed embankments have been designed assuming the permafrost will remain frozen throughout the life of the embankment. In selecting this type of design for a particular site, many factors that are peculiar to cold regions must be considered. This summary of methods of design, construction and operation of embankment dams in permafrost areas records the successes and some failures that have occurred. Embankment dams have been built and successfully operated in Canada, Greenland, the USSR and Alaska. A number of failures have been reported in the USSR and one in Alaska. Most of the difficulties arose because insufficient attention was given to establishing and maintaining a reliable frozen condition and to controlling seepage.

SR 87-12

PROCEEDINGS, VOL. 1

Snow Symposium, 6th, Hanover, NH, Aug. 12-14, 1986
July 1987
207p.
ADB-115 436
Refs. passim. For individual papers see 42-1404 through 42-1422.

42-1403

Snow physics, Snowfall, Snow cover effect, Infrared radiation, Meetings, Visibility, Light transmission, Sound waves, Light scattering, Radar echoes

SR 87-13
TACTICAL BRIDGING DURING WINTER: 1986 KOREAN BRIDGING EXERCISE
Coutermarsh, B.A.
July 1987
23p.
ADB-114 800
11 refs.

42-568

Ice cutting, River crossings, Ice blasting, Military operation, Bridges, Explosives, Ice control, Winter
Deployment alternatives for the U.S. Ribbon bridge are discussed assuming an ice sheet is present at the crossing site. Ice blasting time and effectiveness with several explosives readily available to the Army are presented. A 1986 Korean winter bridging exercise is detailed where an ice sheet was blasted using C4 explosives in a grid pattern. Ice rubble consolidation was attempted using the Bridge Erection Boat, after which the launch of a bridge bay section was tried. It is shown that ice rubble hinders boat operations and retrieval of the bay sections.

SR 87-14
SALINE ICE PENETRATION: A JOINT CRREL-NSWC TEST PROGRAM
Cole, D.M. et al
July 1987
34p.
ADA-139 206

42-2417

Steves, H.K.
Military operation, Penetration tests, Ice strength, Floating ice, Ice salinity, Projectile penetration, Impact strength, Fracturing, Ice cover thickness
This paper reports on the response of a floating saline ice sheet to penetration and perforation by 25.4-mm-diameter projectiles with 3 nose shapes: a full cone, a truncated cone and a full flat. Impact velocity was varied to produce behavior ranging from slight penetration to complete perforation of the 210- to 230-mm-thick ice sheet. The extent of crushing and fracturing adjacent to the path of the projectile was quantified, indicating the existence of a zone of crushing extending 1 to 2 body diameters into the ice sheet from the cavity wall. A series of shots into free-floating targets indicated that for penetrations of roughly two-thirds of the sheet thickness, the depth of penetration did not vary significantly as the target size was reduced to 24 body diameters. Tests on coated projectiles indicated that no significant abrasion occurred between the ice and the nose area of the projectile. Information is also presented on the effects of gas pressure, nose shape, average sheet temperature and angle of attack on the depth of penetration.

SR 87-15
RATING UNSURFACED ROADS--A FIELD MANUAL FOR MEASURING MAINTENANCE PROBLEMS
Eaton, R.A. et al
Aug. 1987
34p.
ADA-135 521

42-804

Gerard, S. Cate, D.W.
Road maintenance, Surface roughness, Drainage, Trafficability, Pavements, Manuals

SR 87-16
EVALUATION OF THE SHASTA WATERLESS SYSTEM AS A REMOTE SITE SANITATION FACILITY
Martel, C.J.
Aug. 1987
24p.
ADA-135 000
5 refs.

42-1088

Sanitary engineering, Military facilities, Waste disposal, Tanks (containers)
The waterless toilet manufactured by Shasta Manufacturing, Inc., of Redding, California, was evaluated for possible use at remote military training sites and guard stations. A telephone survey of 6 recreational areas indicated that park personnel were generally pleased with the performance of these units. On-site visits did not encounter offensive odors. Proper ventilation and liquid level control were found to be key factors in successful operation. A rational approach to sizing these units was developed on the basis of local pan evaporation rates.

SR 87-17
WORKING GROUP ON ICE FORCES. 3RD STATE-OF-THE-ART REPORT
Sanderson, T.J.O. ed
Sep. 1987
221p.
ADA-191 067
Refs. passim. For individual papers (mostly from different source) see 40-4602 through 40-4539 and 42-3033.

42-3037

Ice loads, Offshore structures, Underwater structures, Sea ice, Ice scoring, Structures, Design, Engineering, Tests
This working group report on ice forces includes individual papers which discuss laboratory results, field measurements, instrumentation, numerical analysis, and iceberg scour. A more detailed abstract appears at the beginning of each individual paper.

SR 87-18
SORPTION OF CHEMICAL AGENTS AND SIMULANTS: MEASUREMENT AND ESTIMATION OF OCTANOL-WATER PARTITION COEFFICIENT
Leggett, D.C.
Sep. 1987
15p.
ADB-117 069
14 refs.

42-1790

Military operation, Chemical composition, Soil pollution, Water flow, Solubility, Time factor, Countermeasures, Analysis (mathematics), Polar regions
Octanol-water partition coefficients were determined experimentally for 8 simulants. These were supplemented with published fragment constants and water solubilities to predict log K(ow) values of several threat agents. These estimates can be used to predict sorption and transport in soils. If correct, organophosphorus agents are more mobile in soil water than previously expected.

SR 87-19
FIELD OBSERVATIONS OF MINE DETECTION IN SNOW USING UHF SHORT-PULSE RADAR
Arcone, S.A. et al
Oct. 1987
24p.
ADB-117 360
11 refs.

42-1953

Delaney, A.J.
Military operation, Radar echoes, Snow depth, Detection, Polar regions, Freeze thaw cycles, Experimentation, Metals
The response to short-pulse radar of land mines emplaced in snow was observed throughout the winter of 1985-86 in Fairbanks, Alaska. The radar produced a pulse of a few nanoseconds duration with a spectrum centered near 900 MHz; resistively loaded dipole antennas were used at two polarizations. The mines--standard anti-armor types and a Plexiglas simulation of one of these--were emplaced at various orientations on or above a cleared ground surface and monitored. There was little change in the mine responses that occur before the ground surface response under conditions of 0 and 35 cm of snow, the maximum depth achieved, as long as the snow was dry. Responses from the migrating freeze-thaw interface in the active layer masked some of the later mine responses. The radar detected no response from several of the mines when the pack began to thaw and temperature was nearly constant at 0 C. Some polarization sensitivity was always evident, depending on the orientation of the mine. In no case was there any response to the Plexiglas simulation. UHF short-pulse radar is an excellent mine detection technique in dry snow so long as mines are metallic, but is unsuitable for detecting small, plastic mines in snow.

SR 87-20
ICE ATLAS 1985-1986: MONONGAHELA RIVER, ALLEGHENY RIVER, OHIO RIVER, ILLINOIS RIVER, KANKAKEE RIVER
Gatto, L.W. et al
Nov. 1987
367p.
ADA-191 863
42-2681
Daly, S.F. Carey, K.L.
Ice conditions, River ice, Maps, Photointerpretation, Aerial surveys, Ice surveys, Ice reporting
The ice maps in this atlas were prepared to document the 1985-86 ice conditions included in study areas for the River Ice Management (RIM) Program, namely river mile 0 to 12 on the Monongahela River, mile 0 to 17 on the Allegheny, mile 0 to 437 on the Ohio, mile 120 to 273 on the Illinois and mile 0 to 21 on the Kankakee. The maps were prepared from interpretation of vertical aerial video imagery taken from low flying aircraft. The interpreted ice conditions were classified into 5 units and transferred to base maps by reference to navigation charts and topographic maps. Ice floes or frazil slush and pans (IFFSP) was the most common ice unit on the lower Monongahela. Fragmented ice cover with open-water areas (FICOWA) was the most common ice unit in the lower Allegheny. Fragmented ice cover (FIC) and FICOWA were the most extensive ice units above Hannibal Dam on the Ohio; ICFSP were predominant below. Solid ice cover (SIC), FIC and FICOWA were the most extensive ice types on the lake-like areas of the Illinois River, while FICOWA and IFFSP predominated elsewhere on the Illinois. SIC and FIC were the most common ice units on the Kankakee River. There were frequent cancellations of flights of the Ohio, Allegheny and Monongahela during the 1985-86 winter because of low cloud ceilings. Various options are being explored to get more frequent coverage in the future.

SR 87-21
CRITICAL COMPARISON OF MOVING AVERAGE AND CUMULATIVE SUMMATION CONTROL CHARTS FOR TRACE ANALYSIS DATA
McGee, I.E. et al
Nov. 1987
57p.
ADA-133 312
20 refs.
42-1775
Grant, C.L.
Waste disposal, Chemical analysis, Environmental impact, Soil pollution, Isotope labeling, Detection
Percentage recovery estimates have been obtained for 15 analytes or surrogates of environmental concern by four commercial laboratories over a two-year period. These quality control analyses were performed using standardized methods on a control soil matrix. Over 100 lots of results were available for many of these analytes. This massive amount of data afforded an opportunity to compare the sensitivity of different quality control protocols for detecting "out-of-control" situations and also to compare the performance of the four laboratories. Recoveries averaged 90-100% for 11 of 15 analytes. Reproducibility of recovery estimates was surprisingly consistent from lab-to-lab. From a comparison of moving average control charts (n=2 and n=3) with cumulative summation charts, the n=3 moving average charts were considered most suitable for routine lot-to-lot control by contractors. The cumulative summation charts are very useful for situations requiring critical diagnostic analysis of problems. Where duplicate recoveries were obtained with each lot, lot-to-lot variability was similar in magnitude to within-lot variability. To avoid an excessive number of out-of-control responses, control limits should be based on total variability rather than within-lot variability.

SR 87-22
COMPARISON OF METHANOL AND TETRAGLYME AS EXTRACTION SOLVENTS FOR DETERMINATION OF VOLATILE ORGANICS IN SOIL
Jenkins, T.F. et al
Nov. 1987
26p.
ADA-189 028
23 refs.
42-2498
Schumacher, P.W.
Soil chemistry, Waste disposal, Water pollution, Detection, Solubility
The abilities of methanol and tetraglyme to extract chloroform, benzene, toluene, and tetrachloroethylene from vapor-contaminated soils are directly compared. Comparisons are made both with respect to process kinetics and analyte recovery using an extraction procedure based on equilibration on a wrist-action shaker and determination using a purge-and-trap GC/MS. An equilibration period of 10 minutes is recommended for extraction using either methanol or tetraglyme. In all cases methanol was as good as or better than tetraglyme with respect to analyte recovery. This was even the case for soils contaminated with an oily residue. While commercial methanol and tetraglyme both contain measurable levels of volatile aromatics, simple rotary evaporation was successful in removing these contaminants to levels below detection limits for tetraglyme. Thus, for cases where very small amounts of these contaminants must be detected, degassed tetraglyme would be superior. Overall, however, methanol is considered the best choice for extraction of volatile organics where subsequent analysis is to be conducted by purge-and-trap GC/MS.

SR 87-24
CRREL HOPKINSON BAR APPARATUS
Dutta, P.K. et al
Dec. 1987
29p.
ADA-190 599
21 refs.
42-2635
Farrell, D. Kalafut, J.
Ice strength, Frozen ground strength, Measuring instruments, Ice crystal structure, Low temperature tests, Brittleness, Dynamic loads, Construction materials, Impact strength
Most materials at low temperatures change their modulus and tend to become brittle. When using these materials in structural components that are likely to be subjected to impact it is important to understand their behavior at low temperatures under dynamic loading. The CRREL split Hopkinson Test Bar was designed and set up to conduct compressive strain rate tests (up to 1000 strains/s, i.e., in./in/ per s) at low temperatures (down to -100 C). The results provide dynamic stress-strain relationships of materials at low temperatures by considering the transmission of the stress wave through a test specimen sandwiched between two elastic bars. The specimen is contained in a liquid-nitrogen-operated cooling environment. During the test an elastic striker impacts the bar; as a result a stress wave passes down the bar. At the specimen a part of the wave is reflected and the rest is transmitted to the second bar. Strain gauges mounted on the bars record the wave shapes, which are analyzed to obtain the dynamic stress-strain relationships. The test bars are 1-1/2 in. in diameter and each is 8 ft. long. The apparatus is suitable for testing light metals, plastics, composites, rocks, ice, and frozen soil. The data acquisition and analysis system are completely automatic, using software developed at CRREL, so the system provides for a rapid and low-cost method for high strain rate behavior studies of materials.

SR 87-25
ANALYTICAL METHOD FOR DETERMINING TETRAZENE IN WATER
Walsh, M.E. et al
Dec. 1987
34p.
ADA-189 045
15 refs.
42-2418
Jenkins, T.F.
Explosives, Ground water, Military operation, Chemical analysis, Water pollution
An ion-pairing RP-HPLC method was developed to determine tetrazene in water. The method uses an LC-18 column and a mobile phase of 2/3 v/v methanol-water modified by 0.01 molar 1-decanesulfonic acid sodium salt. The mobile phase pH was adjusted to 3 with glacial acetic acid. The modified mobile phase was optimal for separating of tetrazene from potential interferences by other explosive compounds such as HMX and RDX and for allowing elution of TNT within a 15-minute run time. The retention time for tetrazene was 2.9 minutes. The UV detector was set at 280 nm. A linear model with zero intercept was found to adequately describe the calibration data. The concentration range tested was 6.2-1238 microgram/L. A spike recovery test on each of 4 days gave an average recovery of 103%. A reporting limit of 7.25 microgram/L was estimated. The relative standard deviation was approximately 2% over the range tested. Tetrazene was found to be unstable in an aqueous medium at room temperature. Concentrations decreased by 95-100% over 24 hours. Chilled solutions were less prone to degradation than room temperature solutions, and heated solutions (50 C) degraded completely within two hours.

SR 87-28
XYFREZ.4 USER'S MANUAL
O'Neill, K.
Dec. 1987
55p.
ADA-191 466
3 refs.
42-3159
Heat transfer, Computer programs, Phase transformations, Mathematical models, Latent heat, Heat capacity, Temperature distribution
Using the program XYFREZ, version 4, one may simulate two-dimensional conduction of heat, with or without phase change. The mathematical method employed uses finite elements in space and finite differences in time, and includes latent heat effects through a singularity in the heat capacity. The user need have no real familiarity with either the underlying equations or the numerical procedures. He must only specify material properties, geometrical features, initial and boundary conditions, and information on the desired manner and duration of simulation through time. Heterogeneous material properties may be specified. Boundary conditions currently implemented allow one to specify 1) temperature values which vary arbitrarily in space and time, 2) convective conditions, via a heat transfer coefficient and an ambient temperature, and 3) a no-flux or symmetry condition. The program outputs computed temperature values at numerical mesh points, as well as information for later plotting. From the latter one may see the mesh configuration as well as the phase change isotherm location on it over time.

SR 88-01
ICE CONDITIONS ALONG THE OHIO RIVER AS OBSERVED ON LANDSAT IMAGES, 1972-1985
Gatto, L.W.
Jan. 1988
152p.
ADA-191 172
25 refs.
42-3010
Ice conditions, River ice, Remote sensing, Ice navigation, Aerial surveys, LANDSAT, Photointerpretation, Seasonal variations, United States--Ohio River
Landsat images were used to map ice distributions along the Ohio River. Ice conditions were inferred based on image grey tones interpreted using conventional photointerpretation techniques. Portions of the river that appeared black were considered ice-free. Grey tones were interpreted as ice that varied from patches of thin, snow-free solid or fragmented ice, sometimes with open areas, to floes, pans and slush. A white tone represented thick ice or snow-covered ice with few interspersed open areas. Ice that produced grey tones on the images occurred most frequently. Ice typically forms in late Dec. or early Jan. on the Ohio River and is gone by mid to late Feb. Ice was observed on the upstream section of the river from Pittsburgh to Greenup Dam during 7 of the 13 winters from 1972 to 1985, on the middle section from Greenup Dam to Cannelton Dam during 3 winters, and on the downstream section from Cannelton Dam to the Mississippi River during 4 winters. The most severe and long-lasting ice conditions occurred during the 1976-77 winter when ice covered 65% of the upstream section, 56% of the middle section, and 78% of the downstream section.

SR 88-03
TECHNIQUES FOR MEASURING RESERVOIR BANK EROSION
Gatto, L.W.
Feb. 1988
27p.
ADA-191 400
Refs. p.23-27.
42-3462
Banks (waterways), Shore erosion, Reservoirs, Lakes, Rivers, Sediments
This report summarizes the processes that cause and conditions that contribute to bank erosion along reservoirs, lakes, rivers and coasts. It suggests measurements, techniques and measurement frequencies for four different levels of bank erosion study. Details on specific procedures for a particular technique must be obtained from references cited. There are neither standard measurements to make nor standard methods to use during erosion studies, but this report can be useful to investigators selecting an approach for future work.

SR 88-04
PRELIMINARY DEVELOPMENT OF A FIBER OPTIC SENSOR FOR TNT
Zhang, Y. et al
Mar. 1988
16p.
ADA-191 865
6 refs.
42-2809
Seitz, W.R. Sandberg, D.C. Grant, C.L.
Soil pollution, Detection, Ground water, Optical properties, Military research, Water pollution
Research aimed at the development of a fiber-optic based sensor is described for in-situ detection of TNT in groundwater. Three approaches were evaluated in depth. All three involved use of a material to concentrate TNT in the field of view of an optical fiber. The materials tested were 1) a concentrated dextran solution isolated by a semi-permeable membrane; 2) a pre-swollen cross-linked polyvinyl alcohol polymer; and 3) an amine-loaded PVC membrane. Another approach based on the formation of a colored TNT anion at high pH was also considered. The amine-loaded PVC membrane appears to have the most promise. Clear membranes were prepared which reacted with TNT to form a colored product. Measurement is made at 520 nm which is very convenient for fiber optic-based sensing. Various primary amines were assessed.

MP 1536
WEDDELL-SCOTIA SEA MARGINAL ICE ZONE OBSERVATIONS FROM SPACE, OCTOBER 1984
Carsey, F.D. et al
Journal of geophysical research Mar. 15, 1986 91(C3)
p.3920-3924
12 refs.
41-93
Sea ice, Ice edge, Remote sensing, Antarctica--Weddell Sea, Scotia Sea
Imagery from the shuttle imaging radar-B experiment as well as other satellite and meteorological data are examined to learn more about the open sea ice margin of the Weddell-Scotia Seas region. At the ice edge, the ice forms into bandlike aggregates of small ice floes similar to those observed in the Bering Sea. The radar backscatter characteristics of these bands suggest that their upper surface is wet. Further into the pack, the radar imagery shows a transition to large floes. In the open sea, large icebergs and long surface gravity waves are discernable in the radar images. (Auth.)

MP 1976
HEATING ENCLOSED WASTEWATER TREATMENT FACILITIES WITH HEAT PUMPS
Martel, C.J. et al
Canada. Environmental Protection Service. Water Pollution Control Directorate. Economic and technical review report Dec. 1982 EPS 3-WP-82-6
Symposium on Utilities Delivery in Cold Regions, 3rd, Edmonton, Alta., May 25-26, 1982. Proceedings. Compiled by D.W. Smith
p.262-280
13 refs.
42-1727
Phetteplace, G.
Waste treatment, Water treatment, Heating, Sanitary engineering, Utilities, Pumps, Cost analysis, Winter maintenance

MP 2011
WETTING OF POLYSTYRENE AND URETHANE ROOF INSULATIONS IN THE LABORATORY AND ON A PROTECTED MEMBRANE ROOF
Tobiasson, W. et al
American Society for Testing and Materials. Special technical publication 1988 No.922
p.421-430
Revision of 40-2549. 13 refs.
42-2926
Greatorex, A. Van Pelt, D.
Roofs, Thermal insulation, Polymers, Cellular plastics, Moisture, Temperature gradients, Tests
When subjected to a sustained temperature gradient in the presence of moisture in laboratory wetting tests, urethane and expanded polystyrene roof insulations accumulate enough moisture to reduce their insulating ability significantly. Extruded polystyrene is quite resistant to moisture in such tests. But the vapor drive is not as great in actual roofs, and it may reverse direction, thereby seasonally drying the insulation. To determine how well the laboratory tests could predict the wetting rate of insulation in actual protected membrane roofs, extruded and expanded polystyrene and urethane insulatio s were installed in a protected membrane roof in Hanover, New Hampshire. After three years of exposure, little moisture had accumulated in the extruded polystyrene, and it still retained essentially all of its initial insulating ability. Moisture progressively accumulated in 15-kg/cu m (1-lb/cu ft) and 30-kg/cu m (1.9-lb/cu ft) expanded polystyrene insulations, and at the end of the test they retained only about 30 and 40% of their initial thermal resistance, respectively. The urethane accumulated enough moisture to reduce its insulating ability to about 30% of its dry value. The laboratory tests provided a valuable indication of the potential long-term moisture gain of these insulations when installed in protected membrane roofs in cold regions.

MP 2141
SCATTERING AT MM WAVELENGTHS FROM IN SITU SNOW
Walsh, J. et al
Open Symposium on Wave Propagation: Remote Sensing and Communications, Durham, NH, July 28-Aug. 1, 1986. [Proceedings]. Pre-print volume
International Union of Radio Science, [1986] p.1.6.1-1.6.2
41-95
Cook, R. Layman, R. Berger, R.
Snow optics, Backscattering, Infrared radiation, Wave propagation

MP 2142
LARGE-SCALE ICE-OCEAN MODELING
Hibler, W.D., III
Canadian technical report of hydrography and ocean sciences June 1986 No.73
Canadian East Coast Workshop on Sea Ice, Belford, Quebec, Jan. 7-9, 1986. Proceedings. Compiled by S. Symonds and I.K. Peterson
p.155-184
11 refs.
41-148
Ice water interface, Sea ice distribution, Drift, Ice edge, Ocean currents, Analysis (mathematics)
Utilizing results from diagnostic ice-ocean models of the Arctic, Greenland and Norwegian Seas, physical characteristics and problems related to large-scale ice-ocean modeling are examined. In these models a 14-level baroclinic ocean model has been coupled to a two-thickness-level dynamic-thermodynamic sea ice model utilizing a nonlinear plastic ice interaction. Simulations of the ocean (for the Arctic Basin only) without the ice cover, and of the ice without the ocean model, are also done to examine certain physical problems.

MP 2143
COUPLED ICE-MIXED LAYER MODEL FOR THE GREENLAND SEA
Houssais, M.N.
Canadian technical report of hydrography and ocean sciences June 1986 No.73
Canadian East Coast Workshop on Sea Ice, Belford, Quebec, Jan. 7-9, 1986. Proceedings. Compiled by S. Symonds and I.K. Peterson
p.225-250
29 refs.
41-150
Ice models, Ice water interface, Sea ice, Thermodynamics, Seasonal variations, Heat flux, Convection, Ice melting, Freezing, Analysis (mathematics), Greenland Sea
A thermodynamic coupled ice-mixed layer model, designed to study the seasonal cycle of the ice-ocean interactions in the Greenland Sea is presented. The sea-ice model assumes a constant ice thickness and considers only the variations of ice compactness under the effect of the atmospheric and oceanic heat fluxes. The mixed-layer model predicts the rate of penetrative convection within the water column as a result of both the surface buoyancy flux and the mechanical energy input. The mixed layer is embedded in a three-dimensional primitive equations model which calculates the ocean velocity field and its contribution to the time evolution of the temperature-salinity distribution, and also, following Mamec et al. (1981), helps in describing the pycnocline characteristics at the mixed layer base. The model has been tested without advection or horizontal diffusion through a five-years simulation. The annual entrainment-retreat cycle of the mixed layer is well reproduced together with the advance-decay cycle of the ice cover. The horizontal distribution of the mixed layer depth is in agreement with our knowledge of the effect of an ice cover upon a mainly buoyancy driven oceanic convection.

MP 2144
RIVER AND LAKE ICE ENGINEERING
Ashton, G.D. ed
Littleton, CO, Water Resources Publications, 1986
485p.
Refs. passim.
41-231
River ice, Lake ice, Engineering, Ice physics, Ice mechanics, Ice models, Ice control, Icebreakers, Remote sensing, Thermal regime, Hydraulics, Ice nuclei

MP 2145
SEA ICE AND THE FAIRWAY ROCK ICEFOOT
Kovacs, A. et al
Northern engineer Fall 1985 17(3)
p.25-32
19 refs.

41-337

Sodhi, D.S. Cox, G.F.N.
Ice loads, Offshore structures, Drift, Offshore landforms, Ice pressure, Ice mechanics, Sea ice, Ice cover thickness, Pressure ridges, Bering Strait
The information obtained in this study revealed that a massive icefoot appears to form around Fairway Rock each winter. This icefoot is the result of ice impinging against the island, failing, and subsequently piling up, forming ridges up to 15 m high. The icefoot varies from less than 10 m to over 100 m wide. The slope of the inner ridges averages 33 degrees while the slope of the outer face of the icefoot can exceed 70 degrees. This is apparently the result of nongrounded ice rubble having slumped or been cleaved off. The instructive findings are, as anticipated, that ice rubble formation around a large structure placed in "deep" water will not extend appreciably beyond the width of the structure, and therefore will not add significantly to its effective diameter. In order for this to be so, the submarine slope needs to be relatively steep. At Fairway Rock, it is reasonable to assume that the shallowest submarine slope was at or near the angle of repose of the rock talus.

MP 2146
THEORY OF MICROFRACTURE HEALING IN ICE
Colbeck, S.C.
Acta metallurgica Jan. 1986 34(1)
p.89-95
12 refs.
With French and German summaries.

41-261

Ice cracks, Regelation
The thermodynamics of air- and vapor-filled microfractures in ice is described. Simple models of healing are constructed assuming the cracks are spheroidal. The healing of air-filled cracks is rate limited by vapor diffusion through the air, while the healing of vapor-filled cracks is rate limited by heat flow through the ice. Therefore vapor-filled cracks heal more rapidly. Vapor-filled cracks of less than 5 mm radius and an initial aspect ratio of 1000 can heal to a 1/e decay diurnally. Larger cracks weaken the most, heal more slowly, and are effective longer. A temperature gradient imposed on the ice should accelerate healing, especially in a vapor-filled crack that is oriented perpendicular to the temperature gradient.

MP 2147
MONITORING SEASONAL CHANGES IN SEAFLOOR TEMPERATURE AND SALINITY
Sellmann, P.V. et al
Gas Hydrates, Arctic/Offshore Research, and Deep Source Gas Contractors Review Meeting, Morgantown, WV, Mar. 25-26, 1986. Proceedings. Edited by C.A. Komar Morgantown, WV, U.S. Dept. of Energy, Morgantown Energy Technology Center, July 1986 p.110-114

41-369

Delmnitz, F.
Subsea permafrost, Permafrost thermal properties, Sea water, Water temperature, Water chemistry, Salinity, Seasonal variations, Measuring instruments, Beaufort Sea

MP 2148
PROPOSED CODE PROVISIONS FOR DRIFTED SNOW LOADS
O'Rourke, M. et al
Journal of structural engineering Sep. 1986 112(9)
p.2080-2092
7 refs.

41-405

Tobiasson, W. Wood, E.
Snow loads, Roofs, Snowdrifts, Snow accumulation, Statistical analysis, Forecasting
Current code provisions for drift snow loads on multilevel roofs are examined in light of recent research results from a statistical study of approximately 350 drift load case histories. New provisions are proposed in which the design drift load is a function of the length of the upper-level roof and the 50-yr mean recurrence interval ground snow load. It is felt that these new proposed provisions result in a design drift load with a mean recurrence interval of about 50 yrs.

MP 2149
CORPS OF ENGINEERS LAND TREATMENT RESEARCH AND DEVELOPMENT PROGRAM
Iskandar, I.K.
Technology Transfer Opportunities for the Construction Engineering Community [Conference]. Environment Session, Denver, CO, Feb. 25-27, 1986. Proceedings [1986] p.17-18

41-406

Water treatment, Land reclamation, Soil freezing, Municipal engineering

MP 2150
HEAT DISTRIBUTION RESEARCH
Phetteplace, G.
Technology Transfer Opportunities for the Construction Engineering Community [Conference]. Energy Session, Denver, CO, Feb. 25-27, 1986. Proceedings [1986] p.2-3
1 ref.

41-407

Heat transfer, Frozen ground thermodynamics, Water pipes, Heat loss, Heating, Soil temperature, Distribution, Design

MP 2151
WATER-SOURCE HEAT PUMPS
Phetteplace, G.
Technology Transfer Opportunities for the Construction Engineering Community [Conference]. Energy Session, Denver, CO, Feb. 25-27, 1986. Proceedings [1986] p.14-15
6 refs.

41-408

Water pipes, Pumps, Heating, Heat transfer, Water temperature, Freezing points

MP 2152
EFFECT OF COLD WEATHER ON PRODUCTIVITY
Abele, G.
Technology Transfer Opportunities for the Construction Engineering Community [Conference]. Construction Seminar, Denver, CO., Feb. 25-27, 1986. Proceedings [1986] p.61-65
15 refs.

41-409

Cold weather construction, Cold weather performance, Cold stress, Cold weather tests, Equipment, Snowfall, Wind factors, Temperature effects

MP 2153
MEGASTRUCTURES FOR MOBILIZATION
Flanders, S.N.
Technology Transfer Opportunities for the Construction Engineering Community [Conference]. Mobilization Readiness and Logistics Session, Denver, CO, Feb. 25-27, 1986. Proceedings [1986] p.10-11

41-410

Military facilities, Buildings, Logistics, Structures, Time factor

MP 2154
GLACIERS AND SEDIMENT
Bezinge, A. et al
Alaska. University. Geophysical Institute. Report June 1986 UAG-R (306)
p.53-69
Refs. p.64-67.

41-474

Chacho, E.F. Lawson, D.E.
Glacial deposits, Sediment transport, Glacial hydrology, Glacier surges, Glacier oscillation, United States--Alaska

MP 2155
ICE PROBLEMS ASSOCIATED WITH RIVERS AND RESERVOIRS
Benson, C. et al
Alaska. University. Geophysical Institute. Report June 1986 UAG-R (306)
p.70-98
Refs. p.95-98.

41-475

Calkins, D.J. Chacho, E.F. Lawson, D.E.
Ice conditions, River ice, Reservoirs, Lake ice, Ice control, Ponds, Water reserves, Ice forecasting, United States--Alaska

MP 2156
PERMAFROST
Benson, C. et al
Alaska. University. Geophysical Institute. Report
June 1986 UAG-R (306)
p.99-105
19 refs.
41-476
Chacho, E.F. Kane, D.
Permafrost hydrology, Runoff, Engineering, Glacial rivers, Frozen ground, Mountains, United States--Alaska

MP 2157
MICROSTRUCTURE AND THE RESISTANCE OF ROCK TO TENSILE FRACTURE
Peck, L. et al
Journal of geophysical research Nov. 1985 90(B13)
p.11,533-11,546
Refs. p.11,545-11,546.
41-496
Barton, C.C. Gordon, R.B.
Microstructure, Rocks, Tensile properties, Fracturing, Grain size, Mineralogy, Scanning electron microscopy, Tests, Cracking (fracturing)
The resistance of rock to tensile fracture may be measured by its fracture energy G(I), which is found to range from 40 to 200 J/sq m in tests on nine types of sedimentary and crystalline rock. Differences in microstructure among the rocks tested are the principal cause of differences in the steady state value of G(I), in the distance that a crack must advance before steady state fracturing is attained, and in the amplitude of the fluctuation of G(I) that accompanies crack advance. When nearly continuous surfaces of weakness are present, as in the Salem limestone, G(I) is low and attains steady state after only a small amount of crack advance. When a preexisting, interconnected network of microcracks is exploited by the fracture process, G(I) is large, and steady state is attained only after extended crack propagation. The sensitivity of G(I) to crack speed and the presence of water is low under the test conditions used in all the rocks examined. However, the magnitude of G(I) measured in a given type of rock depends on the configuration of the test specimen and on components of stress near the crack tip that do not influence crack growth in linearly elastic materials. The conditions under which G(I) can be considered a material property are therefore restricted.

MP 2158
NATURAL CONVECTION IN SLOPING POROUS LAYERS
Powers, D.J. et al
International Conference on Finite Elements in Water resources, 6th, Lisboa, Portugal, June 1986.
Proceedings. Edited by A. Sa da Costa, et al
Berlin, Computational Mechanics Publication, [1986]
p.697-710
11 refs.
41-608
O'Neill, K.
Porous materials, Heat transfer, Convection, Fluid flow, Heating, Slope orientation, Analysis (mathematics), Saturation
2-D finite difference simulations of natural convection in a laterally confined, saturated porous medium show distinctive cell patterns and heat transfer characteristics when the medium is inclined relative to the horizontal. A perfectly horizontal layer heated from below exhibits the classical Benard type convection cells, while a vertical medium heated on one side forms a single Rayleigh cell. Progressing from the horizontal to the vertical one sees an evolution of cell forms, each typically featuring a pattern of cell types which alternate longitudinally along the slope. Benard cells rotating in harmony with the Rayleigh forces grow, eventually consuming their weakened counter-rotating neighbors. The latter gradually diminish to the status of transition cells between the dominant types which flank them. Identifiable transitions in flow configuration and cell morphology cause dramatic changes in the efficiency of transverse heat transfer through the layer. These changes have previously been interpreted only as scatter in experimental data.

MP 2159
MOVING BOUNDARY--MOVING MESH ANALYSIS OF PHASE CHANGE USING FINITE ELEMENTS WITH TRANSFINITE MAPPINGS
Albert, M.R. et al
International journal for numerical methods in engineering Apr. 1986 23(4)
p.591-607
27 refs.
41-607
O'Neill, K.
Boundary layer, Phase transformations, Freezing, Analysis (mathematics), Temperature effects, Latent heat, Models
Two-dimensional heat conduction phase change problems are solved using a moving boundary-moving mesh approach. A transfinite mapping technique successfully controls interior mesh motion, and numerical results compare well with analytical solutions. Calculations also agree well with two-dimensional laboratory data for cases featuring time-dependent boundary conditions.

MP 2160
ICE FORCES ON BRIDGE PIERS
Haynes, F.D.
Research on transportation facilities in cold regions. Edited by O.B. Andersland and F.H. Sayles
New York, American Society of Civil Engineers, 1986
p.83-101
Refs. p.99-101.
41-645
Ice loads, Piers, Bridges, Ice physics, Ice strength, Ice deformation, Ice cracks, Design, Impact strength, Models
The force that river ice exerts on bridge piers has been studied in the field and with models in the laboratory. Ice forces are a function of the strength, thickness, failure mode and velocity of the ice, the ice-structure interaction and the geometry of the structure. Results of field measurements on the Yukon and Ottauquechee Rivers are discussed. Results of laboratory tests on vertical structures and sloping structures are presented. Ice failure in crushing, bending (both up and down) and splitting has been observed in the laboratory and the ice forces associated with each mode are presented. A discussion of the measured ice forces with regard to the existing design codes is given.

MP 2161
USE OF TRANSFINITE MAPPINGS WITH FINITE ELEMENTS ON A MOVING MESH FOR TWO-DIMENSIONAL PHASE CHANGE
Albert, M.R. et al
Adaptive computational methods for partial differential equations. Edited by I. Babuska
Philadelphia, Society for Industrial and Applied Mathematics, 1983 p.85-110
15 refs.
41-659
O'Neill, K.
Phase transformations, Freezing, Heat transfer, Stefan problem, Boundary layer, Computer applications, Temperature effects, Analysis (mathematics), Models
The transfinite mapping technique of automatic mesh generation is used with finite elements to solve for two-dimensional heat conduction phase change on a moving mesh. The governing equation is transformed to account for mesh motion, so that coefficients remain attached to moving nodes. The energy conserving attachment of mesh boundaries to phase boundaries avoids approximation across surfaces of discontinuity, and facilitates application of a physical jump condition there. That condition drives boundary motion, while evolution of the interior mesh is determined from boundary node motion via the transfinite mappings. Analytical and computed solutions compare well for the problem of freezing in a corner. Some limitations of both the mapping scheme and this moving finite element system are identified. In conjunction with the latter, a Von Neumann type analysis of the governing equation is outlined, and approximate relations are developed between Stefan number and a numerical Peclet number based on mesh velocity.

MP 2162
TRANSIENT TWO-DIMENSIONAL PHASE CHANGE WITH CONVECTION, USING DEFORMING FINITE ELEMENTS
Albert, M.R. et al
Computational techniques in heat transfer. Edited by R.W. Lewis, et al
Swansea, England, Pineridge Press, Ltd., 1985 p.229-243
15 refs.
41-657
O'Neill, K.
Heat transfer, Phase transformations, Freezeup, Pipes (tubes), Boundary layer, Convection, Flow rate, Analysis (mathematics)

MP 2163
SEA SPRAY ICING: A REVIEW OF CURRENT MODELS
Ackley, S.F.
U.S. Navy Symposium on Arctic/Cold Weather Operations of Surface Ships, Dec. 3-4, 1985. Proceedings
Washington, D.C., Dept. of the Navy, [1986] p.239-262
ADA-168 714
11 refs.
41-936
Ship icing, Sea spray, Heat flux, Ice accretion, Forecasting, Mathematical models, Velocity, Brines, Fog, Ice cover thickness

MP 2164
CLASSIFICATION OF SEASONAL SNOW COVER CRYSTALS
Colbeck, S.C.
Water resources research Aug. 1986 22(9)
p.59S-70S
34 refs.
41-1028
Snow crystal structure, Metamorphism (snow), Snow water content, Freeze thaw cycles, Classifications, Seasonal variations
Snow cover crystals must be classified in a physically meaningful way. Previous classification systems are not sufficiently detailed or not based on sufficient knowledge of the physical processes. A new system is proposed based on our current knowledge of the physical processes of metamorphism. As more information about snow metamorphism is developed, the labels attached to snow grains should evolve too. Two levels of classification are proposed here. For practical purposes only a few terms like rounded and faceted are necessary, but for a more complete description a more detailed system is also given. The most basic description given in the table could be useful to many practitioners, while the more complete description given in the appendix will be necessary for many purposes.

MP 2165
RESPONSE OF PERMAFROST TERRAIN TO DISTURBANCE: A SYNTHESIS OF OBSERVATIONS FROM NORTHERN ALASKA, U.S.A.
Lawson, D.E.
Arctic and alpine research Feb. 1986 18(1)
p.1-7
12 refs.
41-1183
Permafrost preservation, Drilling, Environmental impact, Vegetation, Ground ice, Thermal regime, Ground thawing, Permafrost thermal properties, Revegetation, Thaw depth
Former exploratory drilling sites in the National Petroleum Reserve--Alaska, are examples of the long-term physical modifications resulting from disturbance of perennially frozen terrain. Camp construction and drilling activities in the late 1940s/early 1950s resulted in disturbances which can be grouped by their first modification to the site and its thermal regime: trampling of vegetation, killing the vegetative cover, removal of the vegetative mat, or removal of the vegetation and soil. Removal of the vegetation led to the most extensive modifications at all sites, but the subsequent response to disturbance between sites varied with primarily four factors: (1) ground ice volume, (2) distribution and size of massive ground ice, (3) material properties during thaw, and (4) relief, including progressive changes during thaw subsidence. Variations in response time resulted from the influence of these factors on the type and activity of degradational processes that ensued. Physical stability is required for growth of vegetation and thermal equilibration, and has taken over 30 yr to attain in ice-rich, thaw-unstable areas. Ice-poor, thaw-stable materials in undrained or low relief areas required an estimated 5 to 10 yr for stability; thaw depth measurements suggest that certain of these areas have also equilibrated thermally.

MP 2166
NEW METHOD OF MEASURING THE SNOW-SURFACE TEMPERATURE
Andreas, E.L.
Cold regions science and technology Apr. 1986 12(2)
p.139-156
23 refs.
41-1285
Snow temperature, Surface temperature, Snow cover, Meteorological factors, Hygrometers, Dew point, Water vapor, Saturation, Vapor transfer, Latent heat, Measuring instruments
Because a snow cover is so tenuous, measuring its surface temperature is not easy. The surface is ill-defined and easily disturbed; invasive transducers commonly used for other surfaces are, thus, generally inappropriate for snow. We therefore describe a hygrometric method of measuring the snow-surface temperature. The advantages are that the method is non-invasive, that its accuracy depends only weakly on the surface structure, and that it is reliable even in bright sunlight. The key assumption is that the air at a snow surface is in saturation with the snow; the dew-point temperature of air right at the snow surface is thus the surface temperature. Consequently, under a fairly wide range of conditions we can, in effect, measure the surface temperature by measuring the dew-point temperature 10 cm above the surface. We develop a theoretical justification for the hygrometric measurement, discuss the meteorological parameters that affect the accuracy of the method, and compare hygrometer data with more traditional measurements.

MP 2167
ARCTIC THERMAL DESIGN
Lunardini, V.J.
Mechanical engineering May 1985 107(5)
p.70-75
41-1327
Permafrost thermal properties, Ice accretion, Thermal regime, Polar regions, Freeze thaw cycles, Engineering, Icing, Permafrost preservation, Hot oil lines

MP 2168
ARMY RESEARCH COULD REDUCE DANGERS POSED BY SEA ICE
Tucker, W.B.
Alaska construction and oil Mar. 1984 25(3)
p.20-24
41-1329
Ice strength, Ice physics, Ice cores, Sea ice, Remote sensing, Ice conditions, Engineering, Offshore structures, Offshore drilling, Pressure ridges, Ice pileup, Ice override

MP 2169
EFFECTS OF COLD ENVIRONMENT ON RAPID RUNWAY REPAIRS
Abele, G.
Army Science Conference, June 17-19, 1986. Proceedings, Vol.1
U.S. Department of Defense, [1986] p.1-4
15 refs.
41-1355
Runways, Cold weather construction, Road maintenance, Military engineering, Wind factors, Temperature effects, Snowfall

MP 2170
REMOVAL OF TRACE-LEVEL ORGANICS BY SLOW-RATE LAND TREATMENT
Parker, L.V. et al
Water research Nov. 1986 20(11)
p.1417-1426
35 refs.
41-1389
Jenkins, T.F.
Waste treatment, Water treatment, Land reclamation, Soil pollution, Countermeasures, Degradation, Chemical analysis
A 2 yr study was performed on an outdoor, prototype, slow-rate system to determine the removal efficiency for 15 organic substances in wastewater. The 16 organics were chloroform, benzene, toluene, chlorobenzene, bromoform, m-dichlorobenzene, dibromochloromethane, pentane, hexane, nitrobenzene, m-nitrotoluene, diethylphthalate, PCB 1242, napthalene, phenanthrene and pentachlorophenol. The initial concentration of each of these substances in the wastewater was approx. 50 microgram/l. Initial removal was via volatilization during spray application. The final concentration of substances after spraying correlated well with their calculated liquid-phase transfer coefficients and the substances' initial concentration losses were up to 73% for the most volatile components.

MP 2171
SUITABILITY OF POLYVINYL CHLORIDE WELL CASINGS FOR MONITORING MUNITIONS IN GROUND WATER
Parker, L.V. et al
Ground water monitoring review Summer 1986 6(3)
p.92-93
27 refs.

41-1345

Jenkins, T.F.
Well casings, Ground water, Solutions, Monitors, Materials, Degradation, Soil microbiology
A number of samples of polyvinyl chloride (PVC) well casings used for ground water monitoring that varied in schedule, diameter or manufacturer were placed in contact with low concentrations of aqueous solutions of TNT, RDX, HMX and 2,4-DNT for 80 days. Analysis indicated that there was more loss of TNT and HMX with the PVC casing than with the glass controls, but that the amount lost was, for the most part, equivalent among different types. A second experiment was performed to determine if these losses were due to sorption or if biodegradation was involved. Several different ground water conditions were simulated by varying salinity, initial pH and dissolved oxygen content. The only case where there was an increased loss of any substance due to the presence of PVC casing was with the TNT solution under nonsterile conditions. The extent of loss was small, however, considering the length of the equilibration period. This increased loss is thought to be associated with increased microbial degradation rather than sorption.

MP 2172
IN-SITU ASSESSMENT OF TWO RETROFIT INSULATIONS
Flanders, S.N.
ASHRAE/DOE/BTECC Conference [on] Thermal Performance of the Exterior Envelopes of Buildings, 3rd, Clearwater Beach, FL, Dec. 2-5, 1985. Proceedings Atlanta, GA, American Society of Heating, Refrigerating and Air-Conditioning Engineers, 1985
p.32-44
6 refs.

41-1377

Thermal insulation, Walls, Heat flux, Houses, Moisture meters, Cellular materials, Measuring instruments, Foams
Two retrofit wall insulations were the subject of in-situ R-value measurement and economic assessment of their success for energy conservation. Ft. Lewis, Washington, installed cellulose fiber insulation in the walls of more than 1000 housing units where moisture potentially presented a problem. Ft. Monmouth, New Jersey, added an exterior expanded polystyrene foam insulation system to its many concrete masonry buildings. These represent retrofit insulation methods that have yet to be applied to thousands of military frame and masonry buildings. The R-value measurement included the use of thermography, heat flux transducers, thermocouples and data acquisition equipment. Holes bored in walls gave independent confirmation of composition of the construction layers. Borescope inspection of wall interiors and moisture meter readings of framing sought evidence of moisture and confirmation of voids in cellulose insulation. Measurements of the same or similar buildings occurred approximately a year apart. The economic assessment employed Department of Army life-cycle cost criteria.

MP 2173
ANALYSIS OF SELECTED ICE ACCRETION MEASUREMENTS ON A WIRE AT MT. WASHINGTON
McComber, P. et al
Eastern Snow Conference, 42nd, 1985
[1985] p.34-43
12 refs.

41-1482

Govoni, J.W.
Power line icing, Ice accretion, Ice loads, Transmission lines, Wind velocity, Mathematical models
Although numerical models have been developed to predict the increase in load on transmission lines due to atmospheric icing, there are very few data available with which to verify them experimentally. The accretion of ice on a wire is a complex three-dimensional phenomenon involving torsion of the wire under the accretion weight, vibration, and breaking of some of the ice. In particular, the Mt. Washington test site used for our experiments experiences strong winds that cause high loads, vibrations, and breaking of ice chunks. Load measurements for a few wire-icing events are analyzed to determine the functional relationship between icing load and time, and how this compares with the predictions of some available numerical models. Results indicate that loads for steady icing conditions tend to increase exponentially with time.

MP 2174
HUDSON RIVER ICE MANAGEMENT
Ferrick, M.G. et al
Eastern Snow Conference, 42nd, 1985
[1985] p.96-110
7 refs.

41-1488

Lemieux, G. Gatto, L. Malherin, N.
Ice jams, Ice breakup, River ice, Ice conditions, Ice dams, Ice cover effect, River flow, Ice cover thickness, Flooding, Countermeasures, Water waves
An ice management strategy is being developed for a reach of the Hudson River that experienced ice jam flooding during the 1983-84 winter. Preliminary field studies have focused on developing a technique to induce the breakup of an ice cover or ice jam by releasing water from an upstream dam. During these studies, a series of abrupt releases generated long-period river waves of different magnitudes, durations and spacings that caused changes in river level, flow velocity, and integrity of the ice cover. By monitoring the river elevation and ice cover at several locations, we have found that each of these wave parameters affected the response of the ice cover. The steepness of the wave front depends upon the initial river stage and the amplitude of the release, and is an important parameter affecting the stability of the ice cover. The sequence of events leading to breakup of the relatively thin ice cover on the Hudson was identical to that reported for other rivers having different physical characteristics and much thicker ice. These studies have revealed that pulsed releases of a practical magnitude were effective in removing the ice cover from the reach and provided basic data for analysis of river ice cover breakup.

MP 2175
COMPUTER INTERFACING OF METEOROLOGICAL SENSORS IN A SEVERE WEATHER AND HIGH RFI ENVIRONMENT
Rancourt, K. et al
Eastern Snow Conference, 42nd, 1985
[1985] p.205-211
7 refs.

41-1496

Govoni, J. Oxton, A.
Meteorological instruments, Computer applications, Ice detection, Ice loads, Power line icing, Protection, Thermistors, Radio communication, Transmission lines, Wind factors
Methods are delineated whereby the outputs of ten different sensors used in a study of wind and ice loading on a cable are protected from Radio Frequency Interference (RFI) and severe weather, and processed for logging on a computer. Twelve separate signals from two types of ice detector, two types of cable load cell (including one tri-axial load cell), a pitot-static anemometer, a wind vane and a thermistor are introduced into a Digital Equipment Corporation MINC-11/23 computer. Four of these signals, which would otherwise be incompatible, are conditioned for acceptance by the computer. The signals represent high-speed, consecutive samplings of rapidly changing parameters at a sampling frequency controlled by an operator. Sampled data are logged on a printout and are transferred to magnetic tape for off-site analyses. These methods operate successfully on the summit of Mount Washington, a location known for its harsh weather, in an environment with poor electrical ground and relatively high radio and television frequency interference.

MP 2176
METEOROLOGICAL AND SNOW COVER MEASUREMENTS AT GRAYLING, MICHIGAN
Bates, R.E. et al
Eastern Snow Conference, 42nd, 1985
[1985] p.212-229
5 refs.

41-1497

O'Brien, H.W.
Electronic equipment, Snow cover effect, Snowfall, Snow physics, Snow depth
U.S. Army Cold Regions Research and Engineering Laboratory is currently conducting research programs directed toward determining potential effects of airborne snow, snow cover and various meteorological parameters on electromagnetic systems. These programs required extensive meteorological and snow cover characterization during the winter of 1982-83 and 1983-84 at Camp Grayling, Michigan, which are summarized in this report. The paper also gives a description and discusses the cold weather accuracy and reliability of the automatic recording systems and sensors employed at the snow experiments. Descriptions are given of snow cover measurement techniques, sensors utilized and their accuracy for providing the physical properties of snow cover backgrounds.

MP 2177
EVALUATION OF THE RHEOLOGICAL PROPERTIES OF COLUMNAR RIDGE SEA ICE
Brown, R.L. et al
International Conference on Ice Technology, 1st, Cambridge, MA, June 1986. Proceedings
Berlin, Springer, 1986 p.55-66
14 refs.
41-1582
Richter-Menge, J.A. Cox, G.F.N.
Ice creep, Rheology, Sea ice, Microstructure, Ice strength, Stress strain diagrams, Compressive properties, Porosity, Grain size, Pressure ridges, Ice crystal structure
The rheological properties of columnar multi-year ridge ice tested under uniaxial compression at -5C and -20C are analyzed in terms of the material microstructure. Microstructural parameters considered included porosity and grain size. Strain rates were varied from 1/100,000/sec to 1/100 sec. A single integral representation was used to model the uniaxial material constitutive equation. Results show a definite effect of porosity and strain rate on the mechanical behavior. However, grain size was not found to significantly affect properties, probably because the grain sizes tested for columnar sea ice were all quite large (d=10 to 40 mm). The rheological properties also showed some nonlinearities which have not been observed in nonsaline ice. Finally, a viscoplastic representation is recommended as a formulation which might be better suited for characterizing the properties of sea ice.

MP 2178
FIELD INVESTIGATION OF ST. LAWRENCE RIVER HANGING ICE DAMS, WINTER OF 1983-84
Shen, H.T. et al
U.S. Department of Transportation. St. Lawrence Seaway Development Corporation. Report Aug. 1984
DTSL55-84-C-C0095A
85p.
20 refs.
41-1669
[illegible], R.W. Batson, G.P.
Ice dams, River ice, Frazil ice, Ice cover thickness, River flow, Ice jams, Ice floes, Water temperature

MP 2179
FRICTION OF SOLIDS ON ICE
[illegible], N.P. et al
Dartmouth College, Hanover, NH. Ice Research Laboratory. Report [1986] No.IRL 85/86-012
4p.
Abstract [illegible]
41-2134
Itagaki, K. [illegible], T.E., Jr.
Ice friction, [illegible] interface, [illegible] Theories

MP 2180
AEROSOL EX[illegible] IN T[illegible] TROPOSPHERE
[illegible]
[illegible]
41-1751
[illegible], Atmospheric composition, Aerosols
Parameters observed and reported here are primarily ozone mixing ratios; maximum and minimum ozone amounts noted near the ITCZ; antarctic aerosol concentrations and transport. Uniform aerosol concentrations were observed in the Antarctic troposphere, except in the vicinity of cirrus layers aloft, and in moist or cloudy layers near the surface. Enhanced ozone mixing ratios occurred in troughs about the periphery of Antarctica, and in slightly turbulent layers near mountains. Ozone and aerosol concentrations observed over a wide geographic area of Antarctica were stratified into two altitude classes, and the results mapped. Ozone concentrations in the mid troposphere (550 to 400 mb levels) were small and nearly invariant over the interior of Antarctica. Ozone concentrations in the upper tropospheric (400-300 mb) layers varied greatly, and became quite large over troughs and about the periphery of Antarctica, and in the vicinity of high mountains. Ozone exchange appears quite vigorous in the upper troposphere and frequent aerosol exchange occurs in the lower troposphere, but the stability of the middle troposphere inhibits mixing among these levels. Vertical profiles of aerosol concentration indicate an aerosol decrease of 25 particles/cu cm/Km in clear air over Antarctica. Moist and/or cloudy air over and near the Ross and Weddell Seas is enhanced with aerosols relative to this dry profile. Moist layers over the interior of Antarctica are also enhanced in aerosol concentration in comparison with dry antarctic air. (Auth. mod.)

MP 2181
REGIONAL AND SEASONAL DISTRIBUTIONS OF LOW PRESSURE WEATHER SYSTEMS IN AND AROUND NORWEGIAN WATERS
Bilello, M.A.
International Conference on Polar Lows, Oslo, Norway, May 20-23, 1986. Proceedings. Edited by M. Lystad and O.G. Houmb
[1986] p.53-66
5 refs.
41-1799
Atmospheric circulation, Atmospheric pressure, Surface temperature, Weather observations, Wind (meteorology), Oceans, Meteorological charts, Seasonal variations, Norway
A North Polar region consisting of most of the Scandinavian countries and the major water bodies surrounding these nations was included in a study on the regional and seasonal distributions of low pressure surface weather systems. The region was divided into six zones approximately similar in area, and surface weather maps for three random years were obtained for detailed analysis of daily occurrences of surface lows that passed through these zones. The survey included the lowest isobaric pressure that identified the low, the intensity of the pressure gradient, the zone (or zones) in which the low was located, the frontal system associated with the low and its direction of movement. The results of this comprehensive data set were then summarized and seasonal and regional variations of these lows and their characteristics were obtained.

MP 2182
STRUCTURE AND DIELECTRIC PROPERTIES AT 4.8 AND 9.5 GHZ OF SALINE ICE
Arcone, S.A. et al
Journal of geophysical research Dec. 15, 1986 91(C12)
p.14,281-14,303
35 refs.
41-1857
Gow, A.J. McGrew, S.
Salt ice, Sea ice, Simulation, Ice structure, Dielectric properties
Saline ice slabs removed from ice sheets grown in an outdoor pool have been studied and related to the complex relative dielectric permittivity. The saline ice closely simulated Arctic sea ice in its structural and salinity characteristics which were regularly monitored in a number of ice sheets grown during the winters of 1983-1984 and 1984-1985. In-situ transmission measurements at similar frequencies were also made on the ice sheet itself using antennas located above and beneath the ice. The slab measurements were made during warming from -28 C to -2 C on slabs grown during the winter of 1983-1984 (4.75 GHz) and during a warming and cooling cycle over a slightly larger temperature range on slabs grown during the winter, 1984-1985 (4.80 and 9.50 GHz). Results from the two winters are compared and the differences analyzed. The in-situ measurements showed extremely high attenuation for the young ([illegible] cm) brine-rich ice. Good agreement was found between data for the more desalinated samples and theoretical values predicted by a previously proposed dielectric mixing model that was modified to account for the brine pocket geometry observed in thin sections, and also by including a bulk conductivity term to account for the observed loss (Auth. mod.)

MP 2183
OVERLAND FLOW WASTEWATER TREATMENT AT EASLEY, S.C.
Abernathy, A.R. et al
Water Pollution Control Federation. Journal Apr. 1985 57(4)
p.291-299
12 refs. Discussion by C.J. Martel and T.F. Jenkins, Ibid., Nov. 1986, 85(11), p.1078-1079, 3 refs.
41-1899
Waste treatment, Water treatment, Land reclamation, Chemical analysis, Design

MP 2184

EVALUATION OF SPOT HRV SIMULATION DATA FOR CORPS OF ENGINEERS APPLICATIONS

McKim, H.L. et al

Advances in space research 1985 5(5)

p.51-71

8 refs.

41-1917

Merry, C.J.

Remote sensing, Spectroscopy, Photointerpretation, Data processing, Dredging, Water reserves, Ecology, Brightness

During the summer of 1983 three Corps of Engineers project sites were overflown as part of the SPOT (Système Probatoire d'Observation de la Terre) High Resolution Visible (HRV) simulation campaign. The three sites were Chesapeake Bay, Maryland, Berlin Lake, Ohio, and Lac qui Parle, Minnesota. Multispectral imagery data at a 20-m resolution for three spectral bands (0.50-0.59 micron, 0.61-0.68 micron, 0.79-0.89 micron) were obtained for each of the sites. The data were analyzed for use in dredging, recreation resource management, water quality, and wildlife habitat applications.

MP 2185

FOLDING IN THE GREENLAND ICE SHEET

Whillans, I.M. et al

Journal of geophysical research Jan. 10, 1987 92(B1)

p.485-493

20 refs.

41-1975

Jezek, K.C.

Ice sheets, Ice deformation, Ice structure, Radio echo soundings, Greenland--Dye 3

The deformation of layering into folds is modeled for a linear viscous medium moving over a decollement. Folds are generated by flow variations caused by relief on the decollement, variations in friction, or both. The model is applied to folds forming now in the Greenland ice sheet near Dye 3, for which more complete data are available than for analogous solid earth situations and for which the decollement is at or near the bed. The folds (wavelength 4-8 km) are detected by radio reflection sounding. Measured surface deformation and deformation rate are used with the radar results to test the theory. Calculated fold amplitude is only 20% less than that measured, which *indicates that the theory is substantially correct.* Inversion of the data to calculate basal drag and velocity variations is not helpful for near Dye 3 because many different basal boundary conditions can lead to the observed deformations.

MP 2186

RETENTION AND RELEASE OF METALS BY SOILS--EVALUATION OF SEVERAL MODELS

Amacher, M.C. et al

Geoderma Sep. 1986 38(1-4)

p.131-154

24 refs.

41-2138

Kotuby-Amacher, J. Selim, H.M. Iskandar, I.K.

Soil composition, Soil chemistry, Metals, Solutions, Models

Several kinetic models, including irreversible and reversible 1st, 2nd, and nth order models, and several equilibrium models, including the linear, Langmuir, two-surface Langmuir, and Freundlich models, were evaluated for their ability to describe the retention/release of Cr, Cd, and Hg by various soils. The retention/release data were obtained using a batch reaction method. In general, no single-reaction kinetic model fit the data over the entire time and concentration ranges studied for any of the metals or soils. The relationship between the amount of metal retained by the soil and the concentration of metal in solution was described by either the two-surface Langmuir or Freundlich models. A significant fraction of the metals retained by the soil was not released to solution and was not exchangeable, indicating that some irreversible retention of the metals occurred. The results suggest that a multi-reaction model consisting of irreversible and reversible kinetic models is needed to fit all the data.

MP 2187

BULK TRANSFER COEFFICIENTS FOR HEAT AND MOMENTUM OVER LEADS AND POLYNYAS

Andreas, E.L. et al

Journal of physical oceanography Nov. 1986 16(11)

p.1875-1883

42 refs.

41-2220

Murphy, B.

Polynyas, Sea ice, Heat transfer, Turbulent boundary layer, Mathematical models

To develop a unified method for parameterizing the turbulent transfer from open water surrounded by pack ice, a reanalysis has been made of data reported in the literature on momentum and heat transfer over Arctic leads and polynyas. The neutral stability value of the 10-m drag coefficient, 1.49 (.001, is independent of wind speed and open-water fetch for winds from 1 to 10 m/s and fetches from 7 to 500 m. The neutral stability value of the 10-m transfer coefficient for sensible heat, CHN10, is parameterized with the nondimensional fetch. No compelling reason was found to believe that the bulk transfer coefficient for latent heat is different from CHN10 which implies that horizontal homogeneity may not be a severe constraint for evaluating scalar transfer coefficients. The bulk transfer coefficients actually used in modeling turbulent transfer over leads and polynyas are derivable if the atmospheric stability is known. Lastly, a simple formula is developed for estimating one of the fetch factors from an easily obtainable bulk Richardson number (Auth. mod.)

MP 2188

MICROWAVE DIELECTRIC, STRUCTURAL, AND SALINITY PROPERTIES OF SIMULATED SEA ICE

Arcone, S.A. et al

IEEE transactions on geoscience and remote sensing Nov. 1986 GE-24(6) (Special issue)

International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, Oct. 7-9, 1985. [Proceedings]

p.832-839

15 refs.

41-2297

Gow, A.J. McGrew, S.

Ice crystal structure, Ice electrical properties, Microwaves, Sea ice, Ice salinity, Dielectric properties, Ice physics

The crystalline structure, salinity characteristics, and microwave dielectric properties of artificially grown saline ice are presented. The ice was grown in an outdoor pool containing salt water of 23-25 per mill salinity. The structure and salinity profiles of this ice sheet closely simulated those found in arctic first-year sea ice. The complex relative dielectric permittivity of slabs removed from the ice sheet was measured at 4.75 GHz as a function of temperature. The slabs were placed between open-end waveguide radiators, and dielectric properties were calculated from the forward scattering coefficient. The results show both the real and imaginary parts to vary almost in direct proportion to the brine volume with values for imaginary showing more variation, and are compared with the previous work of others on actual sea ice samples.

MP 2189

PROCEEDINGS

International Offshore Mechanics and Arctic Engineering Symposium, 6th, Houston, Texas, Mar. 1-5, 1987

New York, American Society of Mechanical Engineers, 1987 4 vols.

Refs. passim. For selected papers see 41-2395 through 41-2449.

41-2394

Lunardini, V.J. ed Sinha, N.K. ed Wang, Y.S. ed Goff, R.D. ed

Offshore structures, Offshore drilling, Ice loads, Ice navigation, Permafrost physics, Ice conditions, Ice physics, Engineering, Meetings, Ice solid interface

MP 2190
HEAT TRANSFER CHARACTERISTICS OF A COMMERCIAL THERMOSYPHON WITH AN INCLINED EVAPORATOR SECTION
Zarling, J.P. et al
International Offshore Mechanics and Arctic Engineering Symposium, 6th, Houston, Texas, Mar. 1-5, 1987. Proceedings, Vol.4
New York, American Society of Mechanical Engineers, 1987 p.79-84
11 refs.

41-2435

Haynes, F.D.
Heat transfer, Pipes (tubes), Subgrades, Air flow, Evaporation, Wind velocity, Wind tunnels, Tests, Thermosyphons
Laboratory tests have been conducted on a full-size commercial thermosyphon in an atmospheric wind tunnel located at the U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire. The test variables were evaporator angle, wind speed and heat transfer rate. The effects on thermosyphon performance of nearby walls oriented parallel, at 45 degrees and at right angles to the air flow direction were also studied. Air speed was varied between 0 and 5 meters per second in two increments. Evaporator angles were varied from 0 to 6 degrees in 3-deg increments. Heat transfer rates were varied between 600 and 1500 watts in two increments. The air temperature for all tests was about -17 degrees Celsius. Test results are presented showing thermal conductance of the thermosyphon as a function of wind speed, evaporator inclination angle and heat transfer rate. Heat transfer conductances were determined to increase with increasing wind speed, increase with increasing inclination angle and generally decrease with increasing heat transfer rate.

MP 2191
EXACT SOLUTION FOR MELTING OF FROZEN SOIL WITH THAW CONSOLIDATION
Lunardini, V.J.
International Offshore Mechanics and Arctic Engineering Symposium, 6th, Houston, Texas, Mar. 1-5, 1987. Proceedings, Vol.4
New York, American Society of Mechanical Engineers, 1987 p.97-102
8 refs.

41-2408

Thaw consolidation, Ground thawing, Thawing rate, Strains, Stefan problem, Analysis (mathematics)
The Neumann solution is applicable to the thawing of a soil for which the thaw strain is zero and the density ratio of the frozen and thawed media is one. However, it is well known that the thaw strain for many soils is non-zero. An exact solution of the problem is presented for the case of non-zero thaw strain and variable density ratio. The thaw strain can have a significant effect upon the rate of thaw when compared to the Neumann solution. In some cases the Neumann solution can overpredict the thaw depth by more than 50%.

MP 2192
CONTRIBUTION OF SNOW TO ICE BRIDGES
Coutermarsh, B.A. et al
International Offshore Mechanics and Arctic Engineering Symposium, 6th, Houston, Texas, Mar. 1-5, 1987. Proceedings, Vol.4
New York, American Society of Mechanical Engineers, 1987 p.133-137
5 refs.

41-2414

Phetteplace, G.
Ice crossings, Ice cover strength, Snow (construction material), Freezing, Heat transfer, Bearing strength, Water, Ice cover thickness, Snow depth
The role of snow in the construction of ice bridges is discussed. It is shown that it has limited value as a structural reinforcement and then only by adding water and freezing the resulting slurry. Equations are presented detailing the energy transfer during freezing of a water layer vs a water-snow slurry and the times involved with each. Natural ice thickening is inhibited by the insulating property of the snow, but snow can be used effectively as either a leveling or wearing surface. The snow should be of uniform depth and not mounded or windrowed to avoid deflecting the ice away from the water surface. This would substantially weaken the carrying capacity of the ice bridge.

MP 2193
CONFINED COMPRESSIVE STRENGTH OF HORIZONTAL FIRST-YEAR SEA ICE SAMPLES
Richter-Menge, J.A.
International Offshore Mechanics and Arctic Engineering Symposium, 6th, Houston, Texas, Mar. 1-5, 1987. Proceedings, Vol.4
New York, American Society of Mechanical Engineers, 1987 p.197-207
30 refs.

41-2422

Ice strength, Compressive properties, Sea ice, Ice crystal structure, Strains, Tests, Temperature effects
A total of 110 first-year sea ice samples from Prudhoe Bay, Alaska, were tested in unconfined and confined constant strain rate compression. All of the tests were performed in the laboratory on a closed-loop electrohydraulic testing machine at -10 C. The confined tests were performed in a conventional triaxial cell that maintained a constant ratio between the radial and axial stress to simulate true loading conditions. Three strain rates (1/100, 1/1000, and 1/100,000/s) and three ratios between radial and axial stress (0.25, 0.50, and 0.75) were investigated. This paper summarizes the field sampling and testing techniques and presents data on the effect of confinement on the compressive strength, initial tangent modulus, and failure strain of the ice.

MP 2194
DYNAMIC ANALYSIS OF FAILURE MODES OF ICE SHEETS ENCOUNTERING SLOPING STRUCTURES
Sodhi, D.S.
International Offshore Mechanics and Arctic Engineering Symposium, 6th, Houston, Texas, Mar. 1-5, 1987. Proceedings, Vol.4
New York, American Society of Mechanical Engineers, 1987 p.281-284
6 refs.

41-2433

Ice loads, Dynamic loads, Offshore structures, Ice solid interface, Floating ice, Analysis (mathematics), Ice cover thickness, Velocity, Ice sheets, Surface properties, Ice deformation
The interaction of a sloping structure with a slowly moving ice sheet usually results in bending failure of the ice. The resulting ice blocks are large in area in comparison to their thickness. However, when the velocity of the moving ice increases, the failure mode changes from bending to shear or crushing, resulting in very small pieces. This phenomenon has been observed both in the laboratory and in the field. As yet, no theoretical treatment has been presented to explain this transition. In this paper, a theoretical formulation of the problem is presented in which the ice sheet is treated as an ice beam moving against a sloping structure. The resulting differential equation was solved by the finite element method, and the solution is presented in non-dimensional form.

MP 2195
THEORY FOR THE SCALAR ROUGHNESS AND THE SCALAR TRANSFER COEFFICIENTS OVER SNOW AND SEA ICE
Andreas, E.L.
Boundary-layer meteorology Jan. 1987 38(1-2) p.159-184
Refs. p.182-184.

41-2364

Snow surface, Ice surface, Roughness coefficient, Wind velocity, Snow air interface, Ice air interface
Although the bulk aerodynamic transfer coefficients for sensible (C_H) and latent (C_E) heat over snow and sea ice surfaces are necessary for accurately modeling the surface energy budget, they have been measured rarely. This paper, therefore, presents a theoretical model that predicts neutral-stability values of C_H and C_E as functions of the wind speed and a surface roughness parameter. The crux of the model is establishing the interfacial sublayer profiles of the scalars, temperature and water vapor, over aerodynamically smooth and rough surfaces on the basis of a surface-renewal model in which turbulent eddies continually scour the surface, transferring scalar contaminants across the interface by molecular diffusion. Matching these interfacial sublayer profiles with the semi-logarithmic inertial sublayer profiles yields the roughness lengths for temperature and water vapor. When coupled with a model for the drag coefficient over snow and sea ice based on actual measurements, these roughness lengths lead to the transfer coefficients. C_E is always a few percent larger than C_H. Both decrease monotonically with increasing wind speed for speeds above 1 m/s, and both increase at all wind speeds as the surface gets rougher. Both, nevertheless, are almost always between .001 and .0015.

MP 2196
BANK CONDITIONS AND EROSION ALONG SELECTED RESERVOIRS
Gatto, L.W. et al
Environmental geology and water sciences 1987 9(3)
p.143-154
35 refs.
41-2495
Doe, W.W., III
Shore erosion, Banks (waterways), Frost heave, Frost weathering, Ice scoring, Ice rafting, Ice push

MP 2197
MODELING THE ELECTROMAGNETIC PROPERTY TRENDS IN SEA ICE AND EXAMPLE IMPULSE RADAR AND FREQUENCY-DOMAIN ELECTROMAGNETIC ICE THICKNESS SOUNDING RESULTS
Kovacs, A. et al
U.S. Army Cold Regions Research and Engineering Laboratory. Special report Oct. 1986 SR 86-30
Workshop on Ice Penetration Technology, 2nd, Monterey, CA, June 16-19, 1986. Proceedings
p.57-133
ADB-108 529
Refs. p.131-133.
41-2655
Morey, R.M. Cox, G.F.N. Valleau, N.C.
Ice cover thickness, Electromagnetic properties, Remote sensing, Sea ice, Ice models, Dielectric properties, Electrical resistivity, Brines, Ice physics, Analysis (mathematics)
Two-phase dielectric mixing model results are presented showing the electromagnetic properties of sea ice versus depth. The modeled data are compared with field measurements and show comparable results. It is also shown how the model data can be used in support of impulse radar and airborne electromagnetic remote sensing of sea ice.

MP 2198
VARIABILITY OF ARCTIC SEA ICE DRAFTS
Tucker, W.B. et al
U.S. Army Cold Regions Research and Engineering Laboratory. Special report Oct. 1986 SR 86-30
Workshop on Ice Penetration Technology, 2nd, Monterey, CA, June 16-19, 1986. Proceedings
p.237-256
ADB-108 529
12 refs.
41-2662
Hibler, W.D., III
Ice cover strength, Penetration, Ice cover thickness, Echo sounding, Sea ice distribution, Ice conditions, Climatic factors, Airborne equipment, Seasonal variations

MP 2199
ON THE PROFILE PROPERTIES OF UNDEFORMED FIRST-YEAR SEA ICE
Cox, G.F.N. et al
U.S. Army Cold Regions Research and Engineering Laboratory. Special report Oct. 1986 SR 86-30
Workshop on Ice Penetration Technology, 2nd, Monterey, CA, June 16-19, 1986. Proceedings
p.257-330
ADB-108 529
Refs. p.325-330.
41-2663
Weeks, W.F.
Ice mechanics, Ice structure, Ice cover strength, Ice composition, Ice deformation, Ice cover thickness, Ice temperature, Ice salinity, Ice sheets, Sea ice, Drift

MP 2200
COMPARISON OF THE COMPRESSIVE BEHAVIOR OF NATURALLY AND LABORATORY-GROWN SALINE ICE
Richter-Menge, J.A.
U.S. Army Cold Regions Research and Engineering Laboratory. Special report Oct. 1986 SR 86-30
Workshop on Ice Penetration Technology, 2nd, Monterey, CA, June 16-19, 1986. Proceedings
p.331-350
ADB-108 529
23 refs.
41-2664
Ice salinity, Compressive properties, Ice strength, Stresses, Strains, Temperature effects, Tests, Ice crystal structure, Ice mechanics, Sea ice
A series of unconfined and confined constant strain rate compression tests were performed on columnar, saline ice samples grown in the laboratory. The tests were done at three temperatures (-3, -5 and -10 C) and two strain rates (2 1/50 and 1/1000 per s). The confined compression tests were conducted in a conventional triaxial cell designed to ramp the confining pressure in constant proportion to the axial stress being applied to the cylindrical sample. The ratio of the confining pressure to the axial stress in our tests was 0.25, 0.50 or 0.75. This paper summarizes the results of these tests and compares them to previously obtained first-year sea ice test data. We also compare the crystal structure of the saline ice grown in the laboratory and naturally occurring first-year sea ice. In general, the structural composition and mechanical behavior of the two ice types are similar, indicating that the results obtained from tests on columnar saline ice grown in the laboratory reflect the behavior of first-year sea ice.

MP 2201
SMALL-SCALE PROJECTILE PENETRATION IN SALINE ICE
Cole, D.M. et al
U.S. Army Cold Regions Research and Engineering Laboratory. Special report Oct. 1986 SR 86-30
Workshop on Ice Penetration Technology, 2nd, Monterey, CA, June 16-19, 1986. Proceedings
p.415-438
ADB-108 529
1 ref.
41-2668
Steves, H.K.
Projectile penetration, Ice salinity, Ice deformation, Ice cracks, Impact strength, Tests, Fracturing, Military operation, Models
This paper summarizes the results of a testing program to examine the deformation and fracture associated with projectile penetration in saline ice. Projectiles 25.4 mm in diameter were fired into a naturally-grown saline ice sheet in a test pool at USA CRREL. The tests employed three nose shapes: full cone, truncated cone and full flat. The impact velocities produced behavior ranging from slight penetration to perforation of the 210-280 mm thick ice sheet.

MP 2202
PORTABLE HOT WATER ICE DRILL
Tucker, W.B. et al
U.S. Army Cold Regions Research and Engineering Laboratory. Special report Oct. 1986 SR 86-30
Workshop on Ice Penetration Technology, 2nd, Monterey, CA, June 16-19, 1986. Proceedings
p.549-554
ADB-108 529
4 refs.
41-2676
Govoni, J.W. Garfield, D.E. Farr, R.W.
Ice drills, Thermal drills, Penetration tests, Ice cover thickness, Offshore drilling, Water temperature, Offshore structures, Equipment

MP 2204
PHYSICAL PROPERTIES OF SEA ICE DISCHARGED FROM FRAM STRAIT
Gow, A.J. et al
Science Apr. 24, 1987 236(4800)
p.436-439
11 refs.
41-2806

Tucker, W.B.
Sea ice, Ice physics, Ice structure, Fram Strait
It is estimated that 84 percent of the ice exiting the Arctic Basin through Fram Strait during June and July 1984 was multiyear ice and that a large percentage of this ice is ridged or otherwise deformed. While freeboard and thickness data, together with salinity measurements on cores, usually sufficed to distinguish between first and multiyear floes, preliminary identification could usually be made on the basis of snow cover measurements with snow cover being much thicker on multiyear ice. Cores from the top half meter of multiyear floes were generally very much harder and more transparent than cores from first-year floes. Age estimates of multiyear floes, based on petrographic and salinity characteristics of cores, did not exceed 4 to 5 years for any of the floes that were observed exiting Fram Strait.

MP 2205
PROBLEMS AND OPPORTUNITIES WITH WINTER WASTEWATER TREATMENT
Reed, S.C.
Northern engineer Spring 1985 13(1)
p.16-20
4 refs.
41-2965

Water treatment, Waste treatment, Sludges, Freezing

MP 2206
ICING AND WIND LOADING ON A SIMULATED POWER LINE
Govoni, J.W. et al
Northern engineer Spring 1985 13(1)
p.23-27
10 refs.
41-2967

Ackley, S.F.
Power line icing, Ice loads, Wind factors, Ice accretion, Power line supports

MP 2207
ADVANCES IN ICE MECHANICS--1987
International Symposium and Exhibit on Offshore Mechanics and Arctic Engineering, 6th, Houston, TX, Mar. 1-6, 1987
New York, American Society of Mechanical Engineers, 1987 49p.
Refs. passim. For individual papers see 41-2930 through 41-2[illegible].
41-2929

Chung, J.S. ed, Sodhi, D.S. ed
Ice mechanics, [illegible], Ice strength, [illegible], Ice solid interface, [illegible]

MP 2208
ADVANCES IN SEA ICE MECHANICS IN THE USA
Sodhi, D.S. et al
International Symposium and Exhibit on Offshore Mechanics and Arctic Engineering, 6th, Houston, TX, Mar. 1-6, 1987. [Proceedings.] Advances in ice mechanics--1987. Edited by J.S. Chung, D.S. Sodhi New York, American Society of Mechanical Engineers, 1987 p.[illegible]
105 refs.
41-2933

Cox, G.F.N.
Ice mechanics, Ice strength, Sea ice, Ice loads, Offshore structures, Ice physics, Ice solid interface, Drift, Compressive properties, Models, Petroleum industry
A brief review of significant advances in the field of sea ice mechanics in the United States is presented in this paper. Emphasis is on ice forces on structures, as the subject relates to development of oil and gas resources in the southern Beaufort Sea. The main topics discussed here are mechanical properties, ice-structure interaction, modeling of sea ice drift, and oil industry research activities. Significant advances in the determination of ice properties are the development of testing procedures to obtain consistent results. Using stiff testing machines, researchers have been able to identify the dependence of tensile and compressive strengths on different parameters, e.g., strain rate, temperature, grain size, c-axis orientation, porosity, and state of stress (uniaxial or multiaxial). Now reliable data exist on the tensile and compressive strengths of first-year and multi-year sea ice.

MP 2209
GROWTH, STRUCTURE, AND PROPERTIES OF SEA ICE
Weeks, W.F. et al
NATO Advanced Study Institute on Air-Sea Interaction, Acquafredda di Maratea, Italy, Sep. 28-Oct. 10, 1981. Proceedings. Geophysics of sea ice. Edited by N. Untersteiner. NATO ASI series, Series B: Physics, Vol.146
New York, Plenum Press, 1986 p.9-164
Refs. p.152-164. For another source see 37-2407.
41-2987

Ackley, S.F.
Ice crystal growth, Ice crystal structure, Sea ice, Ice electrical properties, Ice mechanics, Ice thermal properties, Ice physics, Grain size, Gas inclusions, Temperature effects

MP 2210
MECHANICAL BEHAVIOR OF SEA ICE
Mellor, M.
NATO Advanced Study Institute on Air-Sea Interaction, Acquafredda di Maratea, Italy, Sep. 28-Oct. 10, 1981. Proceedings. Geophysics of sea ice. Edited by N. Untersteiner. NATO ASI series, Series B: Physics, Vol.146
New York, Plenum Press, 1986 p.165-281
Refs. p.275-281. For another source see 38-469.
41-2988

Ice mechanics, Sea ice, Ice strength, Ice elasticity, Flexural strength, Fracturing, Rheology, Mechanical properties, Stresses, Strains, Analysis (mathematics)

MP 2211
ICE DYNAMICS
Hibler, W.D., III
NATO Advanced Study Institute on Air-Sea Interaction, Acquafredda di Maratea, Italy, Sep. 28-Oct. 10, 1981. Proceedings. Geophysics of sea ice. Edited by N. Untersteiner. NATO ASI series, Series B: Physics, Vol.146
New York, Plenum Press, 1986 p.577-640
Refs. p.637-640. For another source see 39-896 or 14P-30815.
41-2995

Ice mechanics, Rheology, Drift, Plasticity, Thermodynamics, Oceanography, Sea ice, Ice formation, Ice air interface, Ice strength, Ice cover thickness, Ice models, Sea water, Antarctica--Weddell Sea
Essential aspects of sea ice dynamics of the Arctic and Antarctic on the geophysical scale were reviewed and the role of ice dynamics in air-sea-ice interaction was discussed. The review is divided into the following components: a) a discussion of the momentum balance describing ice drift, b) an examination of the nature of sea ice rheology on the geophysical scale, c) an analysis of the relationship between ice strength and ice thickness characteristics, and d) a discussion of the role of ice dynamics in the atmosphere-ice-ocean system. Because of the unique, highly nonlinear nature of sea-ice interaction, special attention is given to the ramifications of ice interaction on sea ice motion and deformation. These ramifications are illustrated both by analytic solution and by numerical model results. In addition, the role of ice dynamics in the atmosphere-ice-ocean system is discussed in light of numerical modeling experiments, including a fully coupled ice-ocean model of the Arctic-Greenland-Norwegian seas.

MP 2212
MEASUREMENTS OF REFRACTIVE INDEX SPECTRA OVER SNOW
Andreas, E.L.
Society of Photo-Optical Instrumentation Engineers. Proceedings Apr. 1986 Vol.642
p.248-260
33 refs.
41-2984

Refraction, Optical phenomena, Turbulence, Snow optics, Snow air interface

MP 2213
TRANSPORT OF WATER IN FROZEN SOIL 6. EFFECTS OF TEMPERATURE
Nakano, Y. et al
Advances in water resources Mar. 1987 10(1)
p.44-50
9 refs.
41-3019

Tice, A.R.
Soil water migration, Diffusion, Vapor diffusion, Unfrozen water content, Frozen ground temperature

MP 2214
IN-SITU THERMAL CONDUCTIVITY MEASUREMENTS
Atkins, R.T.
Alaska. Dept. of Transportation and Public Facilities. Report June 1983 FHWA-AK-RD-84-06
38p.
3 refs.
41-4070
Construction materials, Thermal conductivity, Soil physics, Thermal insulation, Thermistors
This report describes a method for using commercially available thermistors to make in-situ thermal conductivity measurements with commonly available electronic equipment. The emphasis is on use of a single thermistor to measure thermal conductivities of soils and building insulations. Calibration techniques are explained and examples provided. Limitations on this technique are discussed, including material grain size, amount of material needed for a valid measurement, and temperature stability necessary. Specific examples of the use of this technique are provided for both soil measurements and building material measurements. Data analysis is discussed, including a statistical approach to finding the thermal conductivity in large volumes of material.

MP 2215
INTERACTION OF GRAVEL FILLS, SURFACE DRAINAGE, AND CULVERTS WITH PERMAFROST TERRAIN
Brown, J. et al
Alaska. Dept. of Transportation and Public Facilities. Report Jan. 1984 AK-RD-84-11
35p.
24 refs.
41-4072
Brockett, B.E. Howe, K.E.
Permafrost beneath roads, Culverts, Embankments, Drainage, Gravel, Thermal insulation, Thaw depth, Ground thawing, Permafrost thermal properties
During the summers of 1981 and 1982, the thaw regime of gravel roads and the performance of culverts were observed in the Prudhoe Bay and Kuparuk River oilfields, northern Alaska. This relatively flat to gently rolling coastal plain is covered by shallow lakes, drained lake basins and interconnecting ice-wedge polygons. Depth of seasonal thaw of the predominantly fine-grained soils is less than 50 cm. The permafrost temperature is about -10 C. A combination of visual frost tube readings and temperature measurements were obtained in the roadbed, in an area immediately adjacent to an insulated culvert, and in areas undisturbed by construction. Gravel roads up to 2 m thick thaw completely and thaw penetrates into the consolidated active layer. Where depth of thaw exceeds the thickness of the active layer, ice-rich permafrost begins to thaw. Adjacent to the roads, newly formed surface troughs indicate melting of the underlying ice wedges. Shallow impoundments form on the upslope sides of roads where culverts have not been adequately sited or installed. More standardized practices for culvert placement, installation, and maintenance are desirable to minimize disruption of natural drainage.

MP 2216
EFFECT OF OSCILLATORY LOADS ON THE BEARING CAPACITY OF FLOATING ICE COVERS
Kerr, A.D. et al
Cold regions science and technology Apr. 1987 13(3)
p.219-224
9 refs.
41-3032
Haynes, F.D.
Icing, Vehicles, Static loads, Ice loads, Ice cover strength, Bearing strength, Oscillations, Tests
Parked vehicles with running engines, or motor driven machinery, subject an ice cover to a static load and to a relatively small oscillatory force, that is caused by the moving parts. Since for the driving frequencies in question the dominant feature is fatigue of the ice cover, while it is undergoing non-elastic time-dependent deflections, an experimental program was initiated to study this phenomenon by running a series of tests in one of the cold rooms at CRREL. An electronically driven shaker placed on the ice cover was used to simulate the dynamic case. A loading device of the same weight and base shape was used as a static control in the tests. Each test consisted of placing these two objects on an ice cover and recording how their vertical displacements vary with time, for a fixed driving frequency of the shaker. A comparison of these two curves established the effect of the oscillating force component. Eight tests were conducted. It was found that for urea ice covers and driving frequencies of 1, 10 and 30 Hz (60, 600, and 1800 rpm) the vibrating shaker increased the vertical downward displacements and substantially decreased the time to breakthrough.

MP 2217
ICE NUCLEATION ACTIVITY OF ANTARCTIC MARINE MICROORGANISMS
Parker, L.V. et al
Antarctic journal of the United States 1985 20(5)
p.126-128
12 refs.
41-2955
Sullivan, C.W. Forest, T.W. Ackley, S.F.
Sea ice, Algae, Nucleating agents
A brief review of recent research leads to the conclusion that scavenging is the mechanism by which microorganisms are incorporated in sea ice. Initial studies are presented of the relative ability of melted sea ice and pure cultures of ice algae and ice bacteria to nucleate water droplets. Details of this process are expounded.

MP 2218
PRELIMINARY SIMULATION OF THE FORMATION AND INFILLING OF SEA ICE GOUGES
Weeks, W.F. et al
Environmental Studies Revolving Funds. Report Dec. 1986 No.49
Workshop on Ice Scour Research, Calgary, Alta., Feb. 5-6, 1985. Proceedings. Ice scour and seabed engineering. Edited by C.F.M. Lewis, et al
p.259-268
6 refs.
41-3118
Tucker, W.B. Niedoroda, A.
Sea ice, Ice scoring, Marine deposits, Ocean bottom, Sediment transport, Distribution, Models, Computer applications, Statistical analysis, Beaufort Sea

MP 2219
CORPS OF ENGINEERS SEEK ICE SOLUTIONS
Frankenstein, G.E.
Wisconsin professional engineer Apr. 1987 28(3)
p.5-7
5 refs.
41-3140
Laboratories, Ice mechanics, Models, Ice pressure, River ice, Hydraulic structures, Ice jams, U.S. Army CRREL

MP 2220
ON ESTIMATING ICE STRESS FROM MIZEX 83 ICE DEFORMATION AND CURRENT MEASUREMENTS
Leppäranta, M. et al
U.S. Army Cold Regions Research and Engineering Laboratory. Special report Mar. 1986 SR 86-03
p.17-19
ADA-172 265
4 refs.
41-3055
Hibler, W.D., III Johannessen, O.
Ice deformation, Ice edge, Ice mechanics, Ocean currents, Ocean waves, Wind factors, Stresses, Drift

MP 2221
CRYSTAL STRUCTURE OF FRAM STRAIT SEA ICE
Gow, A.J. et al
U.S. Army Cold Regions Research and Engineering Laboratory. Special report Mar. 1986 SR 86-03
p.20-23
ADA-172 265
8 refs.

41-3056

Tucker, W.B. Weeks, W.F.
Ice crystal structure, Sea ice, Ice composition, Frazil ice, Ice melting, Snow ice, Fram Strait

MP 2222
ACOUSTICAL REFLECTION AND SCATTERING FROM THE UNDERSIDE OF LABORATORY GROWN SEA ICE: MEASUREMENTS AND PREDICTIONS
Stanton, T.K. et al
Acoustical Society of America. Journal Nov. 1986 80(5)
p.1486-1494
30 refs.

41-3068

Jezek, K.C. Gow, A.J.
Ice acoustics, Sea ice, Ice bottom surface, Acoustic measurement, Sound transmission, Scattering
Acoustical reflection and scattering properties of the underside of undeformed sea ice which was grown in an outdoor pool were studied. Echo amplitude fluctuations of normal incidence sonar pings (100-300 kHz) were measured as the sonars moved horizontally under the ice and accumulated into echo amplitude histograms. The Rice probability density function (PDF) was fit to the data and the resultant statistical parameter was combined with the Eckart acoustical scattering theory to estimate an rms roughness of the water/ice interface to be 0.3 mm. Because the ice thin sections showed the ice to be porous and permeable at the interface with dendrites 0.5 mm thick, it appeared that the dendrites controlled the scattering. The average reflection coefficient was of the order 0.05. The low reflection coefficient (low compared to the 0.35 value which is predicted from the bulk properties of sea ice) was attributed to the dendritic structure which was porous and permeable at the water/ice interface. From the data and modeling done, scattering, and, hence, echo fluctuations, for normal incidence sonars of various frequencies and beamwidths were also predicted.

MP 2223
VERIFICATION TESTS FOR A STIFF INCLUSION STRESS SENSOR
Cox, G.F.N. et al
International journal of rock mechanics and mining sciences and geomechanics abstracts Feb. 1987 24(1)
p.[illegible]
[illegible] refs.

41-3301

[illegible], J.B.
[illegible], Strain measuring instruments, [illegible], Ice mechanics, Impurities

MP 2224
CHEMICAL SOLUTIONS TO THE CHEMICAL PROBLEM
Minsk, L.D.
Canadian Building Congress, 4th, Oct. 6-8, 1985. Proceedings. Learning from experience/avoiding failures
Ottawa, Ont., National Research Council, Canada, 1985
p.[illegible]-244
[illegible] refs.
With French summary.

41-3194

Pavements, [illegible] strength, Ice melting, Salting, [illegible], Road icing, Chemical [illegible], Damage, Ice [illegible]

[illegible]

MP 2225
SPACEBORNE SAR AND SEA ICE: A STATUS REPORT
Weeks, W.F.
California. Institute of Technology, Pasadena. Jet Propulsion Laboratory. JPL publication July 1, 1983 No.83-11
NASA-CR-173 185
Spaceborne Imaging Radar Symposium, Pasadena, CA, Jan. 17-20, 1983. Proceedings
p.113-115
N84-16412

41-3347

Sea ice distribution, Remote sensing, Ice conditions, Ice mechanics, Ice surface, Ice cover thickness, Snow temperature, Wind direction

MP 2226
REFERENCE GUIDE FOR BUILDING DIAGNOSTICS EQUIPMENT AND TECHNIQUES
McKenna, C. et al
U.S. Air Force Engineering and Services Center. Technical report July 1985 DEB-TR-86-06
148p.
ADA-179 142
Refs. p.142-148.

41-3359

Munis, R.
Buildings, Indoor climates, Manuals, Heating, Air leakage, Ventilation, Measuring instruments, Engineering

MP 2227
CLASSIFICATION AND LABORATORY TESTING OF ARTIFICIALLY FROZEN GROUND
Sayles, F.H. et al
Journal of cold regions engineering Mar. 1987 1(1)
p.22-48
Refs. p.45-48.

41-2766

Strain tests, Frozen ground strength, Soil freezing, Artificial freezing, Salinity
The proposed guidelines for classifying artificially frozen ground are based on the Unified Soil Classification System, with the addition of salinity evaluation. For testing frozen soils in the laboratory, it is recommended that: axial loading strain rates be 0.1 and 1%/min; constant stress loadings for creep testing be 70, 50, 30, and 10% of the strength values obtained from the constant strain rate test performed at 1%/min; temperatures of the tests be -2, -5, and -10 C; the test specimen shape and size be a right circular cylinder with height-to-diameter ratio of 2 or more and a diameter be at least 10 times that of the largest soil particle size; specimen end caps be lubricated where possible, and the test loading system have a stiffness at least five times that of the test specimen.

MP 2228
SCIENTIFIC CHALLENGES AT THE POLES
Welch, J.P. et al
Sea technology May 1987 28(5)
p.23-26
11 refs.

41-3408

Eppler, D.T. Lohanick, A.
Arctic landscapes, Research projects, Remote sensing, Ice surface, Snow surface, Microwaves

MP 2229
EFFECT OF SNOW ON VEHICLE-GENERATED SEISMIC SIGNATURES
Albert, D.G.
Acoustical Society of America. Journal Apr. 1987 81(4)
p.881-887
[illegible] refs. For previous versions see 40-3531, 40-3544.

41-3887

Snow cover effect, Military operation, Seismology, [illegible], Attenuation, [illegible]

MP 2230
ANNEALING RECRYSTALLIZATION IN LABORATORY AND NATURALLY DEFORMED ICE
Gow, A.J. et al
Journal de physique Mar. 1987 48(3) Supplement p.(C1)271-(C1)276
With French summary. 9 refs.
41-3957
Sheehy, W.
Recrystallization, Ice crystal structure, Ice deformation, Ice strength, Ice crystal nuclei, Ice melting, Pressure
Results are presented of annealing recrystallization in both naturally and laboratory deformed ice. Thin section techniques were used to follow the progress of recrystallization which, in the case of highly compressed ice pellets annealed at -3 C, showed that as soon as any new crystal was nucleated in the deformed ice matrix it retained its lattice orientation over the duration of the recrystallization. Laboratory annealing at ambient pressures of highly deformed, strongly oriented crystal ice from cores deep in the Antarctic Ice Sheet resulted in growth of very large crystals exhibiting c-axis orientations very much degraded with respect to the original ice. Textures and fabrics of the same ice annealed at 200 bars confining pressure closely resembled those observed in ice undergoing dynamic (annealing) recrystallization at 190-200 bars overburden pressure near the base of the ice sheet, which at this location in Antarctica was at pressure melting. (Auth.)

MP 2231
RESTRAINTS ON THIN SECTION ANALYSIS OF GRAIN GROWTH IN UNSTRAINED POLYCRYSTALLINE ICE
Gow, A.J.
Journal de physique Mar. 1987 48(3) Supplement p.(C1)277-(C1)281
With French summary. 8 refs.
41-3958
Ice crystal growth, Ice crystal structure, Grain size, Air entrainment, Bubbles, Tests
Tests were performed at -1 C to evaluate the effects of a free surface and the thickness dimensions of thin sections on the growth of grains in fine-grained, pore-rich, strain-free polycrystalline ice. Results show that negligible growth of grains occurs when the mean size of grains is more than 1.5 to 2 times the section thickness. Grain growth in thicker sections was significant for the fact that grain boundary migration, leading to 3-4 fold increases in average grain size, was virtually unaffected by the presence of large numbers of bubbles in the ice. Nor was there any evidence to indicate any concentrating of bubbles along migrating boundaries. Grain boundary grooving was a characteristic feature of most sections undergoing grain growth. This implies actual migration of grooves during grain growth. The fact that the total length of grooves decreased with increasing grain size also implies some process of groove consumption during grain growth. Three-dimensional grain growth measurements in bulk samples compared favorably with those obtained from sections two to three times thicker than the mean grain diameter. (Auth.)

MP 2232
CHEMICAL PROPERTIES OF SNOW IN THE NORTHEASTERN UNITED STATES
Kumai, M.
Journal de physique Mar. 1987 48(3) Supplement p.(C1)625-(C1)630
With French summary. 7 refs.
41-3959
Snow composition, Chemical properties, Aerosols, Air pollution, Scanning electron microscopy, Snowfall, Wind direction, X ray analysis, Ions, United States--New Hampshire--Hanover
Samples of fresh snow from Hanover, N.H., were found to be slightly acidic, with pH ranging from 3.56 to 5.63, and had electrolytic conductivities in the range 2.52 to 30.0 micros/cm. Snowfalls accompanied by southerly winds from densely populated areas averaged about 3 times higher in hydrogen ion concentration and electrolytic conductivity than snowfalls accompanied by northerly winds from less populated areas. Particles found in fresh snow examined with a scanning electron microscope and an energy dispersive X-ray analyzer were most frequently soil minerals, with some fly ash particles, and occasionally diatoms and pollen. Sulfur-rich black particles were presumed to be from local oil-fired heating and electric power plants, while silicon-rich fly ash particles were assumed to have originated at distant coal-fired electric power plants.

MP 2233
LABORATORY INVESTIGATIONS OF LOW TEMPERATURE CRACKING SUSCEPTIBILITY OF ASPHALT CONCRETE
Janoo, V.C. et al
Paving in Cold Areas Mini Workshop, 3rd, Ottawa, Ontario, July 20-22, 1987. Proceedings, Vol.1
Ottawa, Ministry of Transportation and Communications, July 1987 p.397-415
8 refs.
With Japanese summary.
41-4030
Chamberlain, E.J.
Bituminous concretes, Low temperature tests, Concrete strength, Thermal stresses, Cracking (fracturing), Cement admixtures, Strains, Temperature effects, Rheology, Tests, Tensile properties
A laboratory test program to study the behavior of asphalt concrete at low temperatures is underway at USA CRREL. The effects on strength and thermal stresses and strains, of temperature, temperature cycling, tensile creep, types of asphalt cement and later the influence of additives are included in this investigation. The results from these tests will be used to evaluate, validate and modify two existing thermal cracking models. After verification in the laboratory, the models will be tested in the field. If either model is successful, it is expected that one will be incorporated in the overall Corps of Engineers design procedures for asphalt concrete pavements.

MP 2234
STATEMENT OF RESEARCH NEEDS TO ADDRESS AIRPORT PAVEMENT DISTRESS
Vinson, T.S. et al
Paving in Cold Areas Mini Workshop, 3rd, Ottawa, Ontario, July 20-22, 1987. Proceedings, Vol.2
Ottawa, Ministry of Transportation and Communications, July 1987 p.981-1012
11 refs.
With Japanese summary.
41-4050
Berg, R.L. Tomita, H.
Airports, Cold weather performance, Pavements, Cracking (fracturing), Frost heave, Ice cover effect, Snow cover effect, Thermal stresses, Bearing strength, Freeze thaw cycles, Damage, Drainage
In early fall 1984, the Federal Aviation Administration (FAA), funded the U.S. Army Cold Regions Research and Engineering Laboratory (USACRREL) to conduct a study of airport pavements in cold regions of the United States. At USACRREL's request, the American Association of Airport Executives (AAAE) sent a questionnaire to over 325 general aviation airports in cold regions. The results from over 200 responses were compiled and evaluated and over 20 airport managers were contacted for additional details. Site visitations were made to 35 airports to obtain additional information. The most common pavement problems identified in the study were associated with non-traffic-related phenomena and included: (1) pre-existing cracks reflecting through asphalt concrete overlays, (2) thermal cracking and (3) longitudinal cracking. Most of the airports experienced (1) water pumping up through cracks and joints in the pavements during spring thaw, or (2) additional roughness due to differential frost heave in the winter, or both problems. Many airport managers reported that debris was generated at cracks during the winter and spring. Pavement problems can often be traced to the evolutionary history of general aviation airports and the lack of consideration for site drainage. Based on the recognition of these problems, several future research programs are identified.

MP 2235
SUMMARY OF PROPER COLD WEATHER PAVEMENT REPAIR METHODS
Eaton, R.A.
Paving in Cold Areas Mini Workshop, 3rd, Ottawa, Ontario, July 20-22, 1987. Proceedings, Vol.2
Ottawa, Ministry of Transportation and Communications, July 1987 p.1013-1027
5 refs.
With Japanese summary.
41-4051
Pavements, Cold weather construction, Bituminous concretes, Damage, Road maintenance, Freeze thaw cycles, Drainage, Construction materials, Compaction, Equipment, Sealing
Currently available portable construction equipment can provide hot asphalt concrete on a year-round basis in cold regions. This permits rapid and permanent repairs to pavements if potholes occur or utility cuts are made when the local hot asphalt concrete plants are closed for the winter.

MP 2236
PORTABLE HOT-WATER ICE DRILL
Tucker, W.B. et al
Cold regions science and technology June 1987 14(1)
p.57-64
5 refs. For another version see 41-2676.
41-4216
Govoni, J.W.
Ice drills, Thermal drills, Penetration tests, Ice cover thickness, Offshore drilling, Water temperature, Offshore structures, Equipment
A portable hot-water drilling system has been developed for conducting detailed thickness surveys of multi-year sea ice. Primary components of the system are a propane-fired water heater and a twin-piston pump which is driven by a small gasoline engine. When assembled, the system is mounted on a sled which can be moved across relatively smooth ice surfaces by two persons. The system components easily fit inside a Bell 205 or 212 helicopter for movement to other locations. A field program in April and May 1986 proved the viability of the system for rapidly penetrating multi-year sea ice in relatively cold ambient temperatures. The prototype drill penetrated ice at rates of 3 m/min. A 43-cm-diameter ring can be quickly substituted for the normal drilling probe. This ring is useful for making larger holes through the ice for the release or recovery of instruments. Overall performance of the drilling system was highly satisfactory during the field investigations. Future systems, however, will incorporate fuel oil burners and higher-pressure pumps to achieve higher penetration rates as well as to take advantage of more readily available fuel sources.

MP 2237
RIVER WAVE RESPONSE TO THE FRICTION-INERTIA BALANCE
Ferrick, M.G. et al
National Conference on Hydraulic Engineering, Williamsburg, VA, Aug. 3-7, 1987. Proceedings
New York, American Society of Civil Engineers, 1987
p.764-769
2 refs.
41-4222
Asce, N.
River flow, Water waves, Wave propagation, Friction, Unsteady flow, Ice jams, Ice breakup, Floods, Analysis (mathematics)
The changing character of the solution of the Saint-Venant equations for river flow problems with the dimensionless parameter F(I) reflects a changing balance between friction and inertia. I linearize and place these equations in nondimensional form, and obtain solutions or consider the structure of the solution in different ranges of F(I). The solutions for inertia-dominated flow and for friction-dominated flow have similar form but represent fundamentally different physical processes. In treating the transition between these extremes I identify and obtain expressions for the frictional attenuation of disturbances transmitted by dynamic waves.

MP 2238
DIAGNOSTIC ICE-OCEAN MODEL
Hibler, W.D., III et al
Journal of physical oceanography July 1987 17(7)
p.987-1015
36 refs.
41-4208
Bryan, K.
Ocean currents, Sea ice, Ice water interface, Mathematical models
A coupled ice-ocean model suitable for simulating ice-ocean circulation over a seasonal cycle is developed by coupling a dynamic thermodynamic sea ice model with a multilevel baroclinic ocean model. This model is used to investigate the effect of ocean circulation on seasonal sea ice simulations by carrying out a simulation of the Arctic, Greenland and Norwegian seas. The ocean model contains a linear term that damps the ocean's temperature and salinity towards climatology. The damping term was chosen to have a three-year relaxation time, equivalent to the adjustment time of the pack ice. No damping, however, was applied to the uppermost layer of the ocean model, which is in direct contact with the moving pack ice. This damping procedure allows seasonal and shorter time-scale variability to be simulated in the ocean, but does not allow the model to drift away from ocean climatology on longer time scales. For the standard experiment, an initial integration of five years was performed at one-day time steps and a 1.45 deg by 1.45 deg resolution in order to obtain a cycle equilibrium. For comparison, a five-year simulation with an ice-only model, and shorter one-year sensitivity simulations without surface salt fluxes and without ocean currents, were also carried out. Input fields consisted of climatological surface air temperatures and mixing ratios, together with daily geostrophic winds from 1979. Operational features of the model are described and an analysis is given in terms of the advance and retreat of the ice edge, ice melt fluxes, heat transport and atmospheric heat balance. (Auth. mod.)

MP 2239
CHEMICAL FRACTIONATION OF BRINE IN THE MCMURDO ICE SHELF, ANTARCTICA
Cragin, J.H. et al
Journal of glaciology 1986 32(112)
p.307-313
With French and German summaries.
21 refs. For different source see 38-698 or 13P-28806.
41-4281
Gow, A.J. Kovacs, A.
Ice cores, Ice salinity, Ice composition, Ice shelves, Ice physics, Antarctica--McMurdo Sound
During the austral summers of 1976-77 and 1978-79, several ice cores were taken from the McMurdo Ice Shelf brine zone to investigate its thermal, physical, and chemical properties. Chemical analyses of brine samples from the youngest (uppermost) brine wave show that, except for the advancing front, it contains sea salts in normal sea-water proportions. Further inland, deeper and older brine layers, though highly saline (S>200 per mill), are severely depleted in (SO4)2-/Na+ ratio being an order of magnitude less than that of normal sea-water. Consideration of the solubility of alternative salts, together with analyses of Na+, K+, Ca2+, Mg2+, (SO4)2-, and Cl- concentrations, shows that the sulfate depletion is probably due to selective precipitation of mirabilite, Na2SO4.10H2O. The location of the inland boundary of brine penetration is closely related to the depth at which the brine encounters the firn/ice transition. However, a small but measurable migration of brine is still occurring in otherwise impermeable ice; this is attributed to eutectic dissolution of the ice by concentrated brine as it moves into deeper and warmer parts of the McMurdo Ice Shelf. (Auth.)

MP 2240
PHYSICAL PROPERTIES OF SUMMER SEA ICE IN THE FRAM STRAIT
Tucker, W.B. et al
Journal of geophysical research June 30, 1987 92(C7)
p.6787-6803
37 refs.
41-4238

Gow, A.J. Weeks, W.F.
Ice physics, Sea ice, Ice edge, Snow cover effect, Ice cover thickness, Ice salinity, Ice crystal structure, Seasonal variations, Fram Strait

The physical properties of sea ice in the Fram Strait region of the Greenland Sea were examined during June and July 1984 in conjunction with the Marginal Ice Zone Experiment field program. Most of the ice sampled within Fram Strait during this period was multiyear. Thicknesses and other properties indicated that none of the multiyear ice was older than 4 to 5 years. Snow cover on the multiyear ice averaged 29 cm, while that on first-year ice averaged only 8 cm deep. This difference may be related to enhanced sublimation of the snow on the thinner first-year ice. The salinity profiles of first-year ice clearly show the effects of ongoing brine drainage in that profiles from cores drilled later in the experiment are substantially less saline than earlier cores. Thin section examinations of crystal structure indicate that about 75% of the ice consisted of congelation ice with typically columnar type crystal structure. The remaining 25% consisted of granular ice with only a few occurrences of snow ice. The granular ice consisted primarily of frazil, found in small amounts at the top of floes but mainly observed in multiyear ridges. The horizontally oriented crystal {}axes showed various degrees of alignment, ranging from no alignment to strong alignments in which the alignment direction changed with depth, implying a change in floe orientation with respect to the ocean current at the ice-water interface during ice growth. Evidence of crystal retexturing was observed in the upper meter of nearly every multiyear core. This retexturing, consisting of grain boundary smoothing and nearly complete obliteration of the ice platelet-brine layer substructure, is attributed to summer warming.

MP 2241
MESOSCALE SEA ICE DEFORMATION IN THE EAST GREENLAND MARGINAL ICE ZONE
Leppäranta, M. et al
Journal of geophysical research June 30, 1987 92(C7)
p.7060-7070
23 refs.
41-4261

Hibler, W.D., III
Ice mechanics, Drift, Ice floes, Ice conditions, Microwaves, Ocean currents, Ice edge, Analysis (mathematics)

In this paper, mesoscale (10 km) ice kinematics data obtained during the drift phase of the 1983 Marginal Ice Zone Experiment are analyzed. The measurements were made with a microwave transponder system accurate to better than 1 m. From the point of view of granular media theory, the ice pack was close to ideal. Over the scale of the arr. ' the pack was quite regular, with floes of relatively uniform size closely packed together. The main external driving force for the ice was the ocean current. Simultaneous current measurements were made at three of the strain array sites. The ice behaved in a relatively rigid manner, with more shear than dilatation occurring. Least squares fits of the strain rate tensor showed the deformation field to be quite homogeneous. Superimposed on the rigid motion were smaller fluctuations with a spectrum falling off proportional to frequency to the power of -3/2 to -2. Close examination of individual strain lines showed rather discontinuous distance changes more representative of plastic slip rather than floe bumping. Although a substantial signal at the inertial period was present in the absolute drift, no clear peaks at this period occurred in the spectra of the strain rate tensor invariants. Analysis of the spatial variation of the underlying ocean currents revealed quite a different picture from that of the ice kinematics. In particular, the current field exhibited a much greater spatial variability than the ice motion, with considerable variance at the inertial period. Coherence between the ice and ocean differential velocity was small for all frequencies. Overall, the rigid interactive character of the compact ice cover prevented most of the differential ocean currents from being transferred to the differential ice motion.

MP 2242
ROLE OF FLOE COLLISIONS IN SEA ICE RHEOLOGY
Shen, H.H. et al
Journal of geophysical research June 30, 1987 92(C7)
p.7085-7096
21 refs.
41-4263

Hibler, W.D., III Leppäranta, M.
Ice mechanics, Ice floes, Ice edge, Ice deformation, Stresses, Rheology, Mathematical models, Pack ice

A collisional rheology for an idealized two-dimensional flow of a fragmented ice field is derived. This fragmented ice field is modeled as an assembly of identical smooth disks. Collisions between neighboring disks are caused by the mean deformation field. These collisions transfer momentum which produces the internal stresses in the deforming ice field. By equating the collisional energy losses to the deformational energy, a relationship between the stress and strain rate is quantified. To demonstrate the essential idea, an analytical derivation is first given under quite restricted assumptions. A Monte Carlo simulation is then developed to provide a more general approach for the analysis. It is found that the collisional stresses are proportional to the square of disk diameter and the square of the deformation rate. The magnitude of stresses is also found to increase rapidly as the collisional restitution of disks increases. The collisional rheology yields zero tensile strength. The associated normal flow rule commonly used in the plastic rheology is not valid in the collisional rheology. It is found that the collisional stresses are very small. Consequently, the resulting stress divergence is estimated to be much lower than the air stress typically encountered in the marginal ice zone. However, these collisional stresses become singular as the maximum compactness is reached, indicating that a different mechanism may exist in that extreme.

MP 2243
COLD REGIONS ROOF DESIGN
Tobiasson, W.
Military engineer Aug. 1987 No.516
p.457-458
41-4277

Roofs, Waterproofing, Icing, Snow slides, Design, Moisture, Cold weather construction, Watersheds, Construction materials, Drainage, Polar regions

MP 2244
CHANGES IN THE SALINITY AND POROSITY OF SEA-ICE SAMPLES DURING SHIPPING AND STORAGE
Cox, G.F.N. et al
Journal of glaciology 1986 32(112)
p.371-375
7 refs.
With French and German summaries.
41-4291

Weeks, W.F.
Ice salinity, Porosity, Sea ice, Transportation, Storage

A theoretical examination of salinity and porosity changes introduced in sea-ice samples by brine expulsion and gas entrapment caused by thermal cycling during shipping and storage shows that in extreme cases such effects can be significant, resulting in 15% reductions in porosity (n). More representative scenarios give porosity changes of less than 2% which, assuming that ice-property variations scale with n(1/2), result in property variations of less than 1%.

MP 2245
METHOD OF MEASURING LIQUID WATER MASS FRACTION OF SNOW BY ALCOHOL SOLUTION
Fisk, D.J.
Journal of glaciology 1986 32(112)
p.538-541
3 refs.
With French and German summaries.
41-4311

Snow water content, Unfrozen water content, Temperature measurement, Measuring instruments, Theories, Heat transfer

A method of making field measurements of the liquid water fraction of snow has been developed in which a snow sample is dissolved in methanol to produce a temperature depression. The depression is linearly related to the liquid water content of the snow sample. A single operator can perform four to five measurements per hour with a maximum absolute error of 1.0%.

MP 2246
VENTS AND VAPOR RETARDERS FOR ROOFS
Tobiasson, W.
U.S. Army Cold Regions Research and Engineering Laboratory, [1986] 11p.
Paper presented at the Symposium on Air Infiltration, Ventilation and Moisture Transfer, Ft. Worth, TX, Dec. 1986. 22 refs.
41-4575
Roofs, Air leakage, Moisture, Ventilation, Indoor climates, Humidity, Water vapor, Air temperature, Condensation, Countermeasures

MP 2247
DEVIATION OF GUIDELINES FOR BLASTING FLOATING ICE
Mellor, M.
Cold regions science and technology Feb. 1987 13(2) p.193-206
12 refs.
41-4495
Ice blasting, Projectile penetration, Floating ice

MP 2248
TRAILING-TIRE MOTION RESISTANCE IN SHALLOW SNOW
Blaisdell, G.L.
International Conference of ISTVS, 9th, Barcelona, Spain, Aug. 31-Sep. 4, 1987. Proceedings, Vol.1 Hanover, NH, International Society for Terrain Vehicle Systems (ISTVS), [1987] p.295-304
6 refs.
42-2
Snow strength, Trafficability, Vehicles, Snow cover, Ground thawing, Tires, Snow compaction, Velocity, Tests
Considerable attention has been given to the subject of motion resistance of tires traveling in virgin snow. Trailing tires (those that follow in the rut of a preceding wheel) are generally assumed to provide negligible motion resistance. Levels of resistance for trailing tires were measured with the CRREL Instrumented Vehicle operating in two snow conditions. Using this vehicle, two methods of measuring trailing tire resistance have been explored. Good agreement was found between the methods. A very different balance of leading-tire to trailing-tire resistance was also found for the two snows. For both snows, it is seen that it is not appropriate to assume that trailing-tire resistance is negligible.

MP 2249
PNEUMATICALLY DE-ICED ICE DETECTOR--FINAL REPORT, PHASE 2, PART 1
Franklin, C.H. et al
Ann Arbor, MI, Franklin Engineering Company, May 1986
9p. + append.
42-55
Rogne, C.O. Vinton, C.S.
Ice detection, Ice removal, Equipment, Ice formation, Measuring instruments, Wind factors, Ice accretion, Loads (Forces)

MP 2250
THEORY OF PARTICLE COARSENING WITH A LOG-NORMAL DISTRIBUTION
Colbeck, S.C.
Acta metallurgica July 1987 35(7)
p.1583-1588
With French and German summaries. 22 refs.
42-69
Metals, Low temperature tests

MP 2251
CHEMICAL, PHYSICAL AND STRUCTURAL PROPERTIES OF ESTUARINE ICE IN GREAT BAY, NEW HAMPSHIRE
Meese, D.A. et al
Estuarine, coastal and shelf science June 1987 24(6)
p.833-340
5 refs.
42-66
Gow, A.J. Mayewski, P.A. Ficklin, W. Loder, T.C.
Ice physics, Ice composition, Ice structure, Sea ice, Estuaries

MP 2252
FLOATING DEBRIS CONTROL; A LITERATURE REVIEW
Perham, R.E.
Repair, Evaluation, Maintenance, and Rehabilitation Research Program. Technical report June 1987 REMR-HY-2
22p. + 41p. of append.
18 refs.
42-98
Hydraulic structures, Flood control, Water pollution, Damage, Maintenance, Equipment, Tests
Floating debris can have an extremely harmful effect on certain hydraulic structures such as flood control works and navigation facilities and is consequently an important concern in maintenance and repair activities. This report assembles information found in published sources about equipment and methods used to control floating debris. Also included is an appendix on booms, their functions in the water transportation of pulpwood, and results of laboratory tests of various boom designs which was previously published by the Pulp and Paper Research Institute of Canada and which contains much useful information applicable to booms for control of floating debris.

MP 2253
VIBRATION ANALYSIS OF THE YAMACHICHE LIGHTPIER
Haynes, F.D.
International journal of analytical and experimental modal analysis Apr. 1986 1(2)
p.9-18
For another version see 40-1881. 14 refs.
42-100
Piers, Vibration, Ice loads, Shear strength, Mathematical models, Computer applications

MP 2254
SPECTRAL MEASUREMENTS IN A DISTURBED BOUNDARY LAYER OVER SNOW
Andreas, E.L.
Journal of the atmospheric sciences Aug. 1, 1987 44(15)
p.1912-1939
96 refs.
42-95
Turbulent boundary layer, Snow surface, Snow air interface, Wind velocity, Air temperature, Humidity
Time series were measured of the turbulent fluctuations in longitudinal (u) and vertical (w) velocity and in temperature (t) and humidity (q) with fast-responding sensors in the near-neutrally stable surface layer over a snow-covered field. These series yielded individual spectra, u-w, w-t, w-q, and t-q cospectra, and phase and coherence spectra for nondimensional frequencies (fz/U) from roughly 0.001 to 10. This is, thus, one of the most extensive spectral sets ever collected over a snow-covered surface. With the exception of the u-w cospectra, all of the spectra and cospectra displayed the expected dependence on frequency in an inertial or inertial-convective subrange. At this complex site, turbulence alone determines the spectra and cospectra at high frequency, while at low frequency, the spectra and cospectra reflect a combination of topographically generated turbulence and, probably, internal waves. From the measured temperature and humidity spectra and the t-q cospectra, refractive index spectra for light of 0.55 micron and millimeter wavelengths were computed, the first such spectra obtained over snow. From the u, t and q spectra, the surface sensible (Hs) and latent (Hl) heat fluxes were estimated using the inertial-dissipation technique. Aspects of these computed and estimated values are discussed. (Auth. mod.)

MP 2255

OPTICAL PROPERTIES OF ICE AND SNOW IN THE POLAR OCEANS. 1. OBSERVATIONS

Perovich, D.K. et al

SPIE--The International Society for Optical Engineering. Proceedings 1986 Vol.637

Ocean optics 8. Edited by M.A. Blizard

p.232-241

38 refs.

42-193

Maykut, G.A. Grenfell, T.C.

Ice optics, Snow optics, Sea ice, Brines, Albedo, Scattering, Ice spectroscopy, Ice cover effect, Temperature effects

Optically sea ice is a complex material with an intricate and highly variable structure which includes brine pockets, air bubbles, brine channels and internal platelet boundaries. Large variations in the optical properties of the surface layer can occur on horizontal scales of only a few meters, complicating efforts to quantify larger scale interactions between shortwave radiation and the ice-ocean system. Radiative transfer in sea ice is dominated at visible wavelengths by scattering rather than absorption. Because scattering in the ice is essentially independent of wavelength, spectral variations in the optical properties are primarily the result of differences in absorption. Observations show that albedos are particularly sensitive to the presence of liquid water in the surface layers, the effect being most pronounced at wavelengths above 600 nm. Albedos and extinction coefficients in the ice vary inversely with brine volume, and thus temperature. Below the eutectic point, precipitation of solid salts causes a sharp increase in scattering and corresponding increases in albedo and absorption. Biological activity in natural sea ice often affects light transmission and absorption, particularly in coastal regions and in the southern ocean. Phase function measurements indicate that the scattering distribution in sea ice is only weakly dependent on wavelength and brine volume.

MP 2256

OPTICAL PROPERTIES OF ICE AND SNOW IN THE POLAR OCEANS. 2. THEORETICAL CALCULATIONS

Grenfell, T.C. et al

SPIE--The International Society for Optical Engineering. Proceedings 1986 Vol.637

Ocean optics 8. Edited by M.A. Blizard

p.242-251

25 refs.

42-194

Perovich, D.K.

Ice optics, Snow optics, Sea ice, Analysis (mathematics), Albedo, Solar radiation, Ice microstructure, Brines, Temperature effects, Grain size

Radiative transfer models of sea ice applied to date range from a simple Bouguer-Lambert representation for net downwelling irradiance through 16 stream models which takes into account detailed variations in ice microstructure. Both sea ice and snow are strongly multiple scattering media with single scattering albedos well above 0.9 through the visible and into the near infrared. Parameter studies indicate that the optical properties of sea ice are controlled by the density of brine and vapor inclusions which in general undergo substantial seasonal changes. Melting and brine drainage are the principal causes of these variations. For ice below -5 C, temperature effects are relatively weak unless the T(ice) drops below the eutectic point. The optical properties of snow depend primarily on grain size, the bulk density, and the presence of impurities such as carbon soot. The theoretical models appear to be able to reproduce observations quite well and have revealed that soot or dust contamination of snow appears to be prevalent even in the Arctic.

MP 2257

OPTICAL CHARACTERIZATION OF SEA ICE STRUCTURE USING POLARIZED LIGHT TECHNIQUES

Gow, A.J.

SPIE--The International Society for Optical Engineering. Proceedings 1986 Vol.637

Ocean optics 8. Edited by M.A. Blizard

p.264-271

11 refs.

42-196

Ice optics, Recrystallization, Ice structure, Sea ice, Polarization (waves), Ice crystal structure, Brines, Ice crystal size, Light transmission, Reflection, Ice salinity, Ice temperature

Optical properties of sea ice depend to a greater or lesser extent on its crystalline properties and on the size, shape, and distribution of brine inclusions systematically trapped in the ice crystals. The use of polarized light techniques was demonstrated to examine the internal structure of sea ice. Using both naturally occurring and laboratory simulated sea ice we show how the crystalline and salinity components originate including discussion of the mechanisms by which first-year ice desalinates and recrystallizes into multi-year ice exhibiting optical properties significantly different from those of first-year ice.

MP 2258

PARAMETERS AFFECTING THE KINETIC FRICTION OF ICE

Akkok, M. et al

Journal of tribology July 1987 109(3)

p.552-561

Includes discussion by K. Itagaki and authors' closure. 19 refs.

42-202

Ettles, C.M.M. Calabrese, S.J. Itagaki, K.

Ice friction, Ice solid interface, Temperature effects

MP 2259

OPTICAL SNOW PRECIPITATION GAUGE

Koh, G. et al

Eastern Snow Conference, 43rd, 1986

1987 p.26-31

8 refs.

42-214

Lacombe, J.

Snowfall, Precipitation gages, Snow optics, Measuring instruments, Distribution

The most common quantitative measurement of falling snow is the precipitation rate. The time resolution of conventional mechanical snow gauges is poor, and their accuracy in measuring light snowfall is severely limited. An optical device designed to give an accurate instantaneous measurement of rain rate has been modified to operate in falling snow. Snow rates are inferred from statistical averages of intensity fluctuations caused by snow particles as they fall through a beam of light. Test results show that the optical device is extremely sensitive to light snowfall and may be a significant improvement over mechanical techniques to measure snow precipitation rates.

MP 2261

ALCOHOL CALORIMETRY FOR MEASURING THE LIQUID WATER FRACTION OF SNOW

Fisk, D.J.

Eastern Snow Conference, 43rd, 1986

1987 p.163-166

2 refs.

42-227

Snow water content, Temperature measurement, Snow ice interface, Unfrozen water content, Calorimeters, Latent heat, Ice volume, Specific heat, Measuring instruments

Equipment and procedure have been devised for measuring the liquid water/ice ratio of snow. The measurement is based on the temperature depression observed on dissolving a 25 g snow sample at 0 C in 80 g methanol at 0 C. The masses of the sample and alcohol are held constant, and the heat of solution of 25 g water in 80 g methanol at zero deg is constant, so the only variable is the water/ice ratio in the sample. The solution process occurs quickly enough that it is essentially adiabatic. The latent heat of fusion of up to 8.3 g ice is supplied by the heat of solution of the water in the alcohol. The heat of fusion of any ice above 8.3 g is supplied by a decrease in the solution temperature. Since the total latent heat of fusion varies linearly with ice content, and the solution specific heat is virtually constant, the final solution temperature also varies linearly with sample ice content.

MP 2262
INTERCOMPARISON OF SNOW COVER LIQUID WATER MEASUREMENT TECHNIQUES
Boyne, H.S. et al
Eastern Snow Conference, 43rd, 1986
1987 p.167-172
3 refs.

42-228

Fisk, D.J.
Snow water content, Snow cover, Unfrozen water content, Temperature measurement, Meltwater, Tests
The amount and distribution of liquid water is important for assessing the mechanical strength, meltwater generation and meltwater transmission in snow cover. It also has a profound effect on the performance of active and passive remote sensing systems operating the microwave and millimeter wave region of the electromagnetic spectrum. Recently, an alcohol calorimeter method of measuring liquid water has been reported which is simpler than the freezing calorimeter. It is of interest to intercompare the two methods to show equivalence and to assess the errors of each. The intercomparison was made in a laboratory cold room with homogeneous snow having a mass liquid water content from 0% to 15%. The intercomparison shows that the two methods are equivalent and that the experimental errors associated with the measurements are consistent with what is expected from an error analysis of each method.

MP 2263
PAVEMENT ICING DETECTOR--FINAL REPORT
Goldstein, N. et al
Contract No.DACA33-86-C-0014
Burlington, MA, Spectral Sciences, Inc., Jan. 1987
26p. + append.
Prepared for USA CRREL. 8 refs.

42-274

Richtsmeier, S.C.
Road icing, Pavements, Ice detection, Ice formation, Measuring instruments, Design, Safety, Experimentation, Noise (sound)

MP 2264
EXOTHERMIC CUTTING OF FROZEN MATERIALS
Garfield, D.E. et al
Cold regions science and technology Aug. 1987 14(2)
p.181-188
2 refs.

42-288

Haynes, F.D.
Ice cutting, Ground thawing, Ice melting, Gravel, Frozen ground, Sands, Equipment, Heat sources
A commercially available cutting torch which uses consumable steel cutting rods was evaluated for cutting ice, and frozen sand, gravel, and silt. This relatively simple, lightweight torch was envisioned to have potential applications for producing shallow small-diameter holes in frozen ground for anchors, grounding rods, guy wire stakes, etc. Specific energies for cutting the frozen materials compared reasonably well with other thermal processes, but as expected, were much higher (i.e. less efficient) than mechanical cutting processes. Major advantages of the torch include portability, short set-up time, and its ability to melt a variety of materials.

MP 2265
SNOW METAMORPHISM AND CLASSIFICATION
Colbeck, S.C.
NATO Advanced Institute on Seasonal Snowcovers: Physics, Chemistry, Hydrology, Les Arcs, France, July 13-25, 1985. Proceedings. Edited by H.G. Jones and W.J. Orville-Thomas. Seasonal snowcovers: physics, chemistry, hydrology
Dordrecht, Holland, D. Reidel Publishing Co., 1987
p.1-35
Refs. p.29-35.

42-1148

Metamorphism (snow), Ice crystal growth, Water vapor, Water flow, Isotopes, Classifications
The flow of water vapor in dry snow and crystal growth from the vapor are reviewed to provide a basis for understanding the metamorphism of dry snow. The movement of isotopes with the vapor is also described. The growth of grains in water-saturated snow is described in some detail because it is the best known example of metamorphism. Grain clusters and melt-freeze grains dominate wet snow at low liquid contents. After the principles and observations are all described, a snow classification scheme is proposed.

MP 2266
TECHNOLOGY AND COSTS OF WASTEWATER APPLICATION TO FOREST SYSTEMS
Crites, R.W. et al
Institute of Forest Resources, Contribution No.56
Forest Land Applications Symposium, Seattle, WA, June 25-28, 1985. Proceedings. Edited by D.W. Cole, C.L. Henry and W.L. Nutter. Forest alternative for treatment and utilization of municipal and industrial wastes
Seattle, WA, University of Washington Press, 1986
p.349-355
14 refs.

42-1194

Reed, S.C.
Waste treatment, Forest land, Water treatment, Land reclamation, Irrigation, Cost analysis, Maintenance
Land treatment of municipal wastewater on forest land has been practiced experimentally for over twenty years and on a full-scale basis for over ten. The technology of land application consists of sprinkler irrigation using solid-set (fixed) sprinklers. Most sprinkler systems have been installed in existing forests using either buried or aboveground laterals. Design guidance for sprinkler spacing and operating pressures for solid-set systems in forests is presented. Costs of installed forest land application systems are also given. Costs and design factors are reviewed for systems at Snoqualmie Pass, Washington; Wolfeboro, New Hampshire; Lake of the Pines, California; Clayton County, Georgia; and State College, Pennsylvania. Operation and maintenance costs are provided for systems at Clayton County, Georgia; West Dover, Vermont; and Kennett Square, Pennsylvania. Reduction of the cost of future systems can be accomplished by minimizing the amount of effluent storage provided. Most forest systems can operate with thirty days storage or less. New technology and new plantations can allow reductions in the cost of wastewater application. Potential revenue from tree harvest can also reduce overall costs.

MP 2267
FROST ACTION PREDICTIVE TECHNIQUES: AN OVERVIEW OF RESEARCH RESULTS
Johnson, T.C. et al
Transportation research record 1986 No.1089
p.147-161
30 refs.

42-435

Berg, R.L. DiMillio, A.
Frost action, Frost heave, Thaw weakening, Frost resistance, Freeze thaw tests, Soil freezing, Tests, Freeze thaw cycles, Models
A 6-year research program has materially advanced the state of knowledge regarding frost heave and thaw weakening affecting roads and airfield pavements. The investigations included development and performance of laboratory tests, development of computer models, testing and data collection at field pavement test sites, and validation of the laboratory procedures and computer models against field data. Specific advances include development of a new freezing test to assess the frost susceptibility of soil; development and validation of a mathematical model serving to predict frost heave and thaw consolidation; development of a laboratory test procedure to determine the resilient modulus of frozen, thawed, and recovering granular soils; and conceptualization and testing of a technique for combining the frost heave and thaw consolidation model, the laboratory resilient modulus test, and a pavement response model to predict the nonlinear resilient modulus of granular soils and base course materials as variables in time and space.

MP 2268
MILITARY SNOW REMOVAL PROBLEMS
Minsk, L.D.
Military engineer Aug. 1987 79(516)
p.452-453

42-673

Snow removal, Military operation

MP 2269
BIT DESIGN IMPROVES AUGERS
Sellmann, P.V. et al
Military engineer Aug. 1987 79(516)
p.453-454

42-674

Brockett, B.E.
Augers, Frozen ground

MP 2270
GROUND FREEZING CONTROLS HAZARDOUS WASTE
Iskandar, I.K.
Military engineer Aug. 1987 79(516)
p.455-456
42-675
Soil freezing, Artificial freezing, Waste disposal

MP 2271
FROST JACKING FORCES ON H AND PIPE PILES EMBEDDED IN FAIRBANKS SILT
Johnson, J.B.
Alaska. Dept. of Transportation and Public Facilities. Report Mar. 1984 AK-RD-84-13
42p. + appends.
For another version see 40-675. 19 refs.
42-679
Frost heave, Pile extraction, Permafrost distribution, Thermopiles, Analysis (mathematics), Temperature effects, Frozen ground mechanics, Countermeasures, Frost penetration

MP 2272
BRITTLENESS OF REINFORCED CONCRETE STRUCTURES UNDER ARCTIC CONDITIONS
Kivekäs, L. et al
Nordic concrete research 1985 No.4
p.111-121
5 refs. For another version see 41-213 (CR 36-02).
42-659
Korhonen, C.J.
Reinforced concretes, Concrete strength, Low temperature tests, Loads (forces), Brittleness, Concrete structures, Impact strength
The behavior of reinforced and unreinforced concrete beams was studied under impact load at low temperatures, and the results were compared with the behavior of reinforcing steel in the Charpy-V impact-tests. Transition temperatures as high as -30 C were obtained in the Charpy-V test whereas at temperatures as low as -63 C no brittle failure occurred in the concrete beams, even in those beams where the rebars were intentionally notched. The impact strength of unreinforced concrete increased considerably at lower temperatures.

MP 2273
RIVER ICE MAPPING WITH LANDSAT AND VIDEO IMAGERY
Gatto, L.W. et al
William T. Pecora Memorial Symposium on Remote Sensing, 11th, Sioux Falls, SD, May 5-7, 1987. Proceedings
Silver Spring, MD, Institute of Electrical and Electronics Engineers, Computer Society Press, 1987
p.352-363
10 refs.
42-1526
Daly, S.F. Carey, K.L.
570.4.M44
River ice, Ice conditions, Remote sensing, Mapping, LANDSAT, Aerial surveys, Photography, Ice navigation
As part of the Corps of Engineers River Ice Management Program, Landsat imagery and low-altitude video imagery were used to map ice conditions along the Ohio, Allegheny, Monongahela, Illinois, and Kankakee Rivers. The imagery was analyzed using photointerpretation techniques. Landsat imagery was used to map river ice from 1972 through 1984. The video imagery was used from 1984 to 1987. Ice conditions on these rivers can change rapidly, often daily, and the areal extent of ice is typically greatest from mid-Jan. to mid-Feb. In spite of the small-scale and limited coverage of Landsat imagery, it is useful for analysis of general river ice conditions, especially during severe winters when ice becomes extensive. Video imagery is an economical means of documenting river ice conditions, although cloud cover, inclement weather, and low ceilings restrict opportunities for more frequent coverage. It also can provide near-real-time data when extreme ice conditions cause navigation emergencies.

MP 2274
ARCTIC MARINE NAVIGATION AND ICE DYNAMICS--SUMMARY FINDINGS
Weeks, W.
Arctic marine technology--Airlie House Workshop, Warrenton, VA, Feb. 26-28, 1973. [Proceedings]
Washington, D.C., [1973] p.85-99
42-733
Ice navigation, Ice mechanics, Ships, Marine transportation, Vehicles, Environmental impact, Meteorology

MP 2275
BASELINE ACIDITY OF PRECIPITATION AT THE SOUTH POLE DURING THE LAST TWO MILLENNIA
Cragin, J.H. et al
Geophysical research letters Aug. 1987 14(8)
p.789-792
38 refs.
42-902
Giovinetto, M.B. Gow, A.J.
Ice composition, Firn, Chemical properties, Antarctica--Amundsen-Scott Station
Measurements of meltwater pH from annual layers of South Pole firn and ice samples ranging in age from 40 to 2000 years B.P. show that precipitation at this remote site has a higher natural acidity than that expected from atmospheric equilibrium with CO2. The average pH of deaerated (CO2-free) samples was 5.64, while air-equilibrated samples averaged 5.37, a pH that is about a factor of two more acidic than the expected background pH of 5.65. The observed "excess" acidity can be accounted for by sulphur and nitrogen cation levels in the samples originating from non-anthropogenic H2SO4 and HNO3. Because of the presence of these naturally occurring acids in South Pole precipitation, a pH of 5.4 is considered a more representative baseline reference pH for acid precipitation studies. (Auth.)

MP 2276
METEOROLOGICAL INSTRUMENTATION FOR CHARACTERIZING ATMOSPHERIC ICING
Bates, R.E. et al
Norway. Elektrisitetsforsyningens forskningsinstitutt, Trondheim. EFI technical report June 1987 No.3439
International Workshop [on] Atmospheric Icing of Structures, 2nd, Trondheim, Norway, June 19-21, 1984. Proceedings. Edited by M. Ervik
p.23-30
4 refs.
Includes discussion.
42-923
Govoni, J.W.
Icing, Structures, Meteorological factors, Hoarfrost, Glaze, Frost, Measuring instruments, Ice detection
The accumulation of rime and glaze ice on structures depends on meteorological variables such as wind, precipitation rate, air temperature, fog density and atmospheric moisture content. However, highly accurate measurements of meteorological variables during periods of icing (including wet snow) that occur in the cold regions of the world are for the most part unavailable due to instrumentation failure or geographic remoteness. For the last 5 years, USACRREL has been modifying, testing, and utilizing state-of-the-art sensors and recording systems for measuring winter environmental conditions. This paper discusses meteorological sensors (including ice detectors) used in adverse cold environments, including the mountainous areas of the northeastern United States. One of the state-of-the-art site-specific sensor packages, the newly developed Environmental Instruments Model 200 Dual Processor Meteorological System, has been thoroughly evaluated during periods of adverse weather and icing. The system has no moving parts, but incorporates two static pair heated resistive sensing elements for measuring wind speed and direction, a platinum resistance thermometer for temperature, and a pressure transducer for atmospheric pressure. Results obtained and problem areas encountered using a number of different sensors in adverse weather conditions at both the CRREL snow-field experiment test sites and high elevation winter icing experiment sites are discussed.

MP 2277
ICE DETECTOR MEASUREMENTS COMPARED TO METEOROLOGICAL PARAMETERS IN NATURAL ICING CONDITIONS
Tucker, W.B. et al
Norway. Elektrisitetsforsyningens forskningsinstitutt, Trondheim. EFI technical report June 1987 No.3439
International Workshop [on] Atmospheric Icing of Structures, 2nd, Trondheim, Norway, June 19-21, 1984. Proceedings. Edited by M. Ervik
p.31-37
18 refs.
Includes discussion.

42-924

Howe, J.B.
Ice detection, Icing, Ice accretion, Structures, Air temperature, Wind velocity, Unfrozen water content, Cloud droplets, Measuring instruments
Several seasons of icing data have been collected under natural icing conditions on the summit of Mt. Washington, New Hampshire. Two models of the Rosemount Ice Detector were evaluated in the context of providing icing intensity data under various conditions. Average temperature, windspeed, liquid water content and median droplet diameter were also recorded for each icing event, the latter two parameters being provided by rotating multicylinders. A measure of icing rate has been calculated from the liquid water content and the wind speed, and has been compared to the ice detector cycling rates. For detectors with long heat-on times, the upper limit (maximum cycling rate) of the detector is easily reached under natural conditions. The detector with long heat-on times also exhibits problems at higher temperatures. At environmental temperatures near freezing, the probe takes considerable time to cool below freezing and begin to again accumulate ice. Thus a maximum cycle rate is reached under these conditions which can be well below the actual icing rate. Under prolonged icing conditions, ice accumulations on the unheated parts of the probe and support structure can interfere with the airflow past the probe, significantly changing the collection efficiency. Under extreme conditions, this can result in a complete lack of cycling. The problems associated with application of the ice detector cycling rates as a measure of accretion rates on more complex objects are also discussed. In particular, the fact that the collection efficiency is so strongly dependent on the droplet size distribution may limit its usefulness.

MP 2278
SELF-SHEDDING OF ACCRETED ICE FROM HIGH-SPEED ROTORS
Itagaki, K.
Norway. Elektrisitetsforsyningens forskningsinstitutt, Trondheim. EFI technical report June 1987 No.3439
International Workshop [on] Atmospheric Icing of Structures, 2nd, Trondheim, Norway, June 19-21, 1984. Proceedings. Edited by M. Ervik
p.95-100
15 refs.
Includes discussion.

42-933

Icing, Propellers, Helicopters, Ice accretion, Supercooled fog, Ice removal, Ice adhesion, Temperature effects, Countermeasures, Ice cover thickness, Tensile properties
Ice accreted on high-speed rotors operating in supercooled fog can be thrown off by centrifugal force, creating severe unbalance and dangerous projectiles. A simple force balance analysis indicates that the strength of accreted ice and its adhesive strength can be obtained by measuring the thickness of the accretion, the location of the separation, the rotor speed and the density. Such an analysis was applied to field and laboratory observations of self-shedding events. The results agree reasonably well with other observations.

MP 2279
COMPUTER MODELING OF ATMOSPHERIC ICE ACCRETION AND AERODYNAMIC LOADING OF TRANSMISSION LINES
Egelhofer, K.Z. et al
Norway. Elektrisitetsforsyningens forskningsinstitutt, Trondheim. EFI technical report June 1987 No.3439
International Workshop [on] Atmospheric Icing of Structures, 2nd, Trondheim, Norway, June 19-21, 1984. Proceedings. Edited by M. Ervik
p.103-109
12 refs.
Includes discussion.

42-934

Ackley, S.F. Lynch, D.R.
Ice accretion, Power line icing, Transmission lines, Wind pressure, Analysis (mathematics), Air flow, Computer applications, Ice forecasting, Models, Supercooling
A time-dependent computer model capable of predicting the accretion of rime ice on a wire free to rotate is described. A finite element technique is used to obtain the air velocity field adjacent to the wire. A local collision efficiency is calculated for several radial sectors of the wire by tracking supercooled water droplets of various sizes until they collide with the wire. The asymmetric buildup of ice causes the wire to rotate, changing the flow field around the wire and the rate of ice accretion. The finite element technique is a very effective method of analyzing this problem because the ice accretion shape is not limited to a simple geometric shape. The drag force is computed as a function of time to investigate the forces acting on the wire during an icing event. Model results are presented including comparisons of icing simulations of wires of various rigidities and lengths.

MP 2280
FOREST LAND TREATMENT WITH MUNICIPAL WASTEWATER IN NEW ENGLAND
Reed, S.C. et al
Institute of Forest Resources, contribution No.56
Forest Land Applications Symposium, Seattle, WA, June 25-28, 1985. Proceedings. Edited by D.W. Cole, C.L. Henry and W.L. Nutter. Forest alternative for treatment and utilization of municipal and industrial wastes
Seattle, WA, University of Washington Press, 1986
p.420-430
12 refs.

42-1195

Crites, R.W.
Waste treatment, Water treatment, Forest land, Land reclamation, Design, Water pollution, Countermeasures
An overview of several case studies of forest land treatment with municipal wastewater in New England is presented. One of the earliest land treatment systems in this area in modern times was installed in 1971 by the state of New Hampshire at Sunapee State Park, in a mature forest of mixed hardwoods and conifers. The system is in excellent condition, and continued operation is planned for the foreseeable future. Municipal forest land treatment systems are also operating successfully at West Dover, Vermont; Wolfeboro, New Hampshire; and Greenville, Maine. Design and operating information is provided for all 4 systems. For West Dover the energy consumption is evaluated and the treatment performance is documented. West Dover operates throughout most winters with minimal storage. The improvements in water quality at several of these systems are also discussed, and a method for estimating phosphorus removal is described.

MP 2281
DETECTING UNDERGROUND OBJECTS/UTILITIES
Hironaka, M.C. et al
Workshop [on] Facilitating Technology Advancement in the U.S. Construction Industry, Austin, TX, Oct. 23-29, 1987. Proceedings
[1987] p.36-43
3 refs.
42-967
Bigl, S.R.
Underground facilities, Detection, Radar echoes, Measuring instruments, Penetration tests
Hand-held detectors and ground penetrating radar systems have been field evaluated to determine their effectiveness in locating underground objects and utilities. The hand-held detectors are limited to locating either metallic or nonmetallic (by radio transmitter) lines and are best suited to tracing such lines. To trace such lines, at least a vague idea of their location must be known or a point of physical access must be available. Ground penetrating radar (GPR), on the other hand, has the capability to detect both metallic and nonmetallic objects without prior knowledge of their presence. However, as presently configured, GPRs have certain deficiencies that resulted in poor performance in field evaluation tests. The best system detected only 60% of the metallic and 36% of the nonmetallic objects that were present in our test site. We therefore have development efforts underway or completed to improve the capabilities of GPRs. These efforts include optimum GPR source signal, high-power focused antenna, and signal processing-image reconstruction software.

MP 2282
INFRARED TESTING FOR LEAKS IN NEW ROOFS
Korhonen, C.
Workshop [on] Facilitating Technology Advancement in the U.S. Construction Industry, Austin, TX, Oct. 23-29, 1987. Proceedings
[1987] p.49-54
4 refs.
42-968
Roofs, Leakage, Infrared reconnaissance, Moisture detection, Thermal insulation, Temperature variations
Newly constructed roofs can develop leaks as soon as they are built, but these leaks may not manifest themselves inside the building until after the warranty has expired. High resolution infrared scanners can be used during the warranty period to locate the wet insulation resulting from these leaks. When combined with detailed visual examination, infrared surveys can help to determine who is responsible for the leak. If the leak is the result of a design or workmanship error, then the building owner is saved the expense of pursuing remedial repairs on a new roof.

MP 2283
COMPARISON OF SNOW COVER LIQUID WATER MEASUREMENT TECHNIQUES
Boyne, H.S. et al
Water resources research Oct. 1987 23(10)
p.1933-1836
19 refs.
42-990
Fisk, D.J.
Snow water content, Unfrozen water content, Snow mechanics, Meltwater, Microwaves, Remote sensing, Temperature measurement, Seepage
The amount and distribution of liquid water are important for assessing the mechanical strength, meltwater generation, and meltwater transmission in snow. Liquid water also has a profound effect on the performance of active and passive remote sensing systems operating in the microwave and millimeter wave region of the electromagnetic spectrum. New methods of measuring liquid water have been reported which show considerable promise. Our purpose is to address the question of measurement equivalence by comparing the three direct methods of freezing calorimetry, alcohol calorimetry, and dilution and by comparing the precision of a calibrated capacitance probe with one of the direct methods. All comparisons were made in a laboratory cold room with snow having a mass liquid water content of 0-14 mkg per 100 mkg of snow. The comparisons show that the methods are equivalent with an uncertainty of ab' t 1.8 mkg per 100 mkg of snow. However, the operational achievement of equivalence is strongly dependent on a variety of factors such as sample size, mixing of snow and working fluid, and operator skill.

MP 2284
CLIMATOLOGY OF RIME ACCRETION IN THE GREEN AND WHITE MOUNTAINS
Ryerson, C.C.
Conference on Mountain Meteorology, 4th, Seattle, WA, Aug. 25-28, 1987. [Proceedings]
Boston, MA, American Meteorological Society, 1987
p.267-272
9 refs.
42-997
Icing, Ice accretion, Hoarfrost, Mountains, Climatology, Statistical analysis

MP 2285
METEOROLOGICAL SYSTEM PERFORMANCE IN ICING CONDITIONS
Bates, R.E.
Electro-Optical Systems Atmospheric Effects Library/Tactical Weather Intelligence (EOSAEL/TWI) Conference, 7th, Las Cruces, NM, Dec. 2-4, 1986. Proceedings
U.S. Army Atmospheric Sciences Laboratory, 1987 p.73-86
5 refs.
42-1037
Ice formation, Icing, Meteorological instruments, Hoarfrost, Models, Climatic factors, Air temperature, Freeze thaw cycles
Adverse weather that induces riming and glaze formations severely affects most conventional meteorological field sensors and frequently causes system failure. Such conditions include temperatures near or just below freezing, frozen precipitation and excessive humidity. These conditions usually accompany major synoptic events which in most cases go unrecorded because of 1) the remoteness of the high elevations where extreme icing and wind normally occur, and 2) the failure of the instrumentation required to characterize the adverse weather.

MP 2286
EXTINCTION COEFFICIENT FOR A DISTRIBUTION OF ICE FOG PARTICLES
Jordan, R.
Electro-Optical Systems Atmospheric Effects Library/Tactical Weather Intelligence (EOSAEL/TWI) Conference, 7th, Las Cruces, NM, Dec. 2-4, 1986. Proceedings
U.S. Army Atmospheric Sciences Laboratory, 1987 p.527-539
15 refs.
42-1039
Ice fog, Infrared radiation, Electromagnetic properties, Attenuation, Particle size distribution, Mathematical models
An approximation model is derived for the attenuation of visible and infrared radiation through ice fog. Assuming spherical particles and single scattering, a formula for estimating the extinction efficiency factor has been developed by combining the approaches of Hart-Montroll and Nussenzveig-Wiscombe. With the use of a Maxwell function to describe the size distribution of ice fog particles, a theoretical integration over the distribution is possible. The resulting extinction coefficient is a function of the mode radius of the distribution, the wavelength of the incident radiation, and the complex refractive index of ice. Its simple formulation provides an efficient means of scaling infrared to visible attenuation.

MP 2287
INTENSITY OF SNOWFALL AT THE SNOW EXPERIMENTS
Bates, R.E. et al
Electro-Optical Systems Atmospheric Effects Library/Tactical Weather Intelligence (EOSAEL/TWI) Conference, 6th, Las Cruces, NM, Dec. 3-5, 1985. Proceedings
White Sands Missile Range, U.S. Army Atmospheric Sciences Laboratory, Feb. 1985 p.205-217
7 refs.
42-1062
King, J.J.
Snowfall, Snow water equivalent, Military operation, Snow accumulation, Visibility, Snowstorms, Remote sensing
Snowfall intensities are currently classified by the National Weather Service Meteorological stations as "light, moderate and heavy" using visibility as a criterion. However, snowfall occurs with other obscurants, such as fog, making it extremely difficult to determine the actual snowfall intensity, therefore any criterion dependent on visibility alone should only be used as a guide. This paper presents a more quantitative method of determining snowfall using snow depth accumulation rate (cm/hr) and total hourly water equivalent (mm) as criteria. Intensive snowfall accumulation rates and water equivalent amounts were determined at the SNOW experiments at Fort Ethan Allen, Vermont, during the winters of 1980-81 and 1981-82, and at Camp Grayling, Michigan, during the winters of 1983-84 and 1984-85. These data are used to validate the preliminary snowfall intensity model.

MP 2288
PERSPECTIVES IN ICE TECHNOLOGY
Ashton, G.D.
[1986] 4p.
Keynote address delivered at the International Conference on Ice Technology, MIT, June 10-12, 1985. (Unpublished manuscript.)
42-1372
Ice physics, Research projects, Engineering, Icing, Ice cover

MP 2289
EFFECT OF ICE-FLOE SIZE ON PROPELLER TORQUE IN SHIP-MODEL TESTS
Tatinclaux, J.-C.
American Towing Tank Conference, 21st, Washington, D.C., Aug. 5-7, 1986. Proceedings. Edited by R.F. Messalle
Washington, D.C., National Academy Press, 1987 p.291-298
4 refs.
42-1352
Ice loads, Propellers, Ice navigation, Ice floes, Ice conditions, Ice solid interface, Velocity, Ice density, Friction, Tests
Results of a laboratory study on ice-propeller interaction conducted with a model icebreaker are presented. The tests were made in ice-free water, precut channels with regularly shaped ice floes of different sizes, and brash-filled ice channels. The test results showed that the propeller torque and its standard deviation increased with both ice floe size and ship speed. The dominant frequency in the torque fluctuations was found to be either the propeller speed or the ratio of ship speed to floe width. The effect of ice ingestion on propeller thrust could not be determined because of malfunction of the thrust component of the propeller dynamometer. The results suggest that difference in ice density and in ice-hull friction coefficient between model tests and full scale trials may be at least partially responsible for the lack of agreement between torque and powering requirements predicted from model propulsion test results and those measured during full-scale trials.

MP 2290
CONFIDENCE IN HEAT FLUX TRANSDUCER MEASUREMENTS OF BUILDINGS
Flanders, S.N.
ASHRAE transactions 1985 91(1)
p.515-531
12 refs.
42-1375
Heat transfer, Buildings, Heat flux, Temperature measurement, Measuring instruments
Confidence in the validity of heat flux transducer (HFT) measurements is sufficiently high that ASTM is preparing a standard practice for the use of HFTs on buildings. A key issue the standard practice will address is how to adjust the calibration of the HFT to the thermal environment of the measurement. Confidence in the use of HFTs is based in part on a propagation of error analysis of key thermal influences on the accuracy of measurement. The user can expect the HFT to render a standard deviation of 10% of the heat flux measured. Field measurements confirm this expectation. However, the variety of heat flux mechanisms inherent in building construction requires that the investigator choose the measuring situation carefully. Convection, even in "fully insulated" spaces, can cause unexpected lateral heat flux and results that are difficult to interpret. More work should be done with HFTs to investigate convection in walls and attics, as well as to investigate other lateral heat flux transfer mechanisms.

MP 2291
PREVIEW OF THE SNOW-III WEST DATA BASE
Lacombe, J.
U.S. Army Cold Regions Research and Engineering Laboratory. Special report July 1987 SR 87-12
Snow Symposium, 6th, Hanover, NH, Aug. 1986. Proceedings
p.3-11
ADB-115 486
5 refs.
42-1404
Snow physics, Military operation, Light transmission, Infrared reconnaissance, Visibility, Meteorological factors, Detection, Snowfall, Precipitation gages
Reduction of data recorded at the SNOW-III West field experiment is complete and a summary report is now being written. A preview of the organization and contents of the upcoming report is given in this paper.

MP 2292
SCAVENGING OF INFRARED SCREENER EA 5763 BY FALLING SNOW
Cragin, J.H. et al
U.S. Army Cold Regions Research and Engineering Laboratory. Special report July 1987 SR 87-12
Snow Symposium, 6th, Hanover, NH, Aug. 1986. Proceedings
p.13-20
ADB-115 486
4 refs.
42-1405
Hewitt, A.D.
Snowfall, Infrared radiation, Light scattering, Snow crystals, Aerosols, Visibility, Ice crystals, Precipitation (meteorology), Wind velocity, Tests, Cloud dissipation
Field tests conducted with EA 5763 in Hanover, NH, Hollis, ME and E. Corinth, VT show that an order of magnitude more screener is removed and deposited at the surface within 30 m downwind during snowfall than under clear-air conditions. Relative amounts of screener deposited by diffusion/gravitation under clear conditions were inversely proportional to the wind speed above a threshold value of about 1 m/s. A direct linear relationship exists between the mass precipitation rate and the fraction of smoke cloud scavenged by stellar, spatial dendritic, and clustered snow crystals. The scavenging efficiency does not appear to depend strongly on snow or ice crystal type although scatter in the data and the limited number (6) of tests may have masked any relationship. Snow is four to five times more efficient than raindrops in scavenging EA 5763 from smoke clouds.

MP 2293
HUMIDITY AND TEMPERATURE MEASUREMENTS OBTAINED FROM AN UNMANNED AERIAL VEHICLE
Ballard, H. et al
U.S. Army Cold Regions Research and Engineering Laboratory. Special report July 1987 SR 87-12
Snow Symposium, 6th, Hanover, NH, Aug. 1986. Proceedings
p.35-45
ADB-115 486
1 ref.
42-1407
Izquierdo, M. McDonald C. Smith, J. Cogan, J. Tibuni, F. Greeley, H.
Meteorological instruments, Air temperature, Humidity, Airplanes, Measuring instruments, Tests, Temperature effects, Accuracy
A small, lightweight, low power consuming instrument designed to measure atmospheric temperature and relative humidity from an unmanned aerial vehicle (UAV) was flight tested. The measurements obtained from the UAV instrument were compared with those obtained from balloon borne instruments. The balloons were launched prior to and just after the UAV flights. Although the measurement accuracy of the UAV instrument could not be established during these tests, the temperature and relative humidity variations noted were consistent with those obtained from the balloon instruments. The temperature variations conformed to the expected lapse rates. Laboratory tests on the performance of the instrument package under varying, particularly cold, temperatures were conducted to determine the environmental effects on instrument sensitivity, accuracy and time constants. Results of these tests are presented.

MP 2294
ACOUSTIC-TO-SEISMIC COUPLING THROUGH A SNOW LAYER
Peck, L.
U.S. Army Cold Regions Research and Engineering Laboratory. Special report July 1987 SR 87-12
Snow Symposium, 6th, Hanover, NH, Aug. 1986. Proceedings
p.47-55
ADB-115 486
42-1408
Acoustics, Snow cover effect, Seismology, Sound waves, Soil mechanics, Military operation, Frost penetration, Experimentation
The excitation of ground motion by airborne sound is termed acoustic-to-seismic coupling. The occurrence of acoustic-to-seismic coupling degrades the performance of a seismic sensor unless its contribution to the ground motion is compensated for, while it is the basis of aircraft detection and ranging by means of an acoustic/seismic sensor. The variation in acoustic-to-seismic coupling due to the winter environment must be known and understood so that the effects of the winter environment can be incorporated in the design and employment of sensor systems.

MP 2295
FORWARD SCATTER METER FOR MEASURING EXTINCTION IN ADVERSE WEATHER
Koh, G.
U.S. Army Cold Regions Research and Engineering Laboratory. Special report July 1987 SR 87-12
Snow Symposium, 6th, Hanover, NH, Aug. 1986. Proceedings
p.81-84
ADB-115 486
2 refs.
42-1411
Attenuation, Light scattering, Radiation, Snowfall, Light transmission, Measuring instruments, Rain, Fog
The extinction coefficient is a measure of the attenuation of radiation as it propagates through the atmosphere. Techniques for measuring the extinction coefficient in optical wavelength regions are of interest, since many military devices detect visible and infrared radiation emitted or reflected by distant targets. Experimental results comparing extinction coefficients measured with a forward scatter meter and a transmissometer show that it is feasible to use a forward scatter meter to measure extinction in winter precipitation (snow, rain and fog).

MP 2296
SLANT PATH EXTINCTION AND VISIBILITY MEASUREMENTS FROM AN UNMANNED AERIAL VEHICLE
Cogan, J. et al
U.S. Army Cold Regions Research and Engineering Laboratory. Special report July 1987 SR 87-12
Snow Symposium, 6th, Hanover, NH, Aug. 1986. Proceedings
p.115-126
ADB-115 486
5 refs.
42-1414
Greeley, H. Izquierdo, M. McDonald, C. Smith, J.
Infrared radiation, Visibility, Light transmission, Cloud cover, Temperature effects, Sounding, Computer applications
The potential for using measurements of infrared radiation from the Earth's surface in the wavelength range of 8-14 micron to obtain an estimate of infrared extinction is examined. The system depends on the reduction of detected radiation with increasing distance from the observed objects. The effects of cloud cover and the temperature and emissivity dependence are considered. Limitations on the operational range are presented. This paper also presents a technique using a video image and computer processing to obtain a measure of visual range from the observed contrast differences in the image. A prior knowledge of scene contrast when visibility is known can be compared with the scene contrast obtained under arbitrary conditions to estimate visibility. A slightly different approach to obtain visual range views horizon and terrain simultaneously. A contrast measurement can then be used to determine visual range if the distance to the horizon is known.

MP 2297
WET PRECIPITATION IN SUBFREEZING AIR BELOW A CLOUD INFLUENCES RADAR BACKSCATTERING
Colbeck, S.C.
U.S. Army Cold Regions Research and Engineering Laboratory. Special report July 1987 SR 87-12
Snow Symposium, 6th, Hanover, NH, Aug. 1986. Proceedings
p.135-144
ADB-115 486
8 refs.
42-1416
Ice crystal growth, Supercooled clouds, Radar echoes, Analysis (mathematics), Backscattering, Temperature effects, Precipitation (meteorology), Unfrozen water content
Ice particles falling through supercooled clouds accrete water droplets fast enough to incur a substantial temperature increase. During conditions of "just wet" growth of fair size graupel particles, the temperature rise can reach several degrees. These wet ice particles would take hundreds of meters to refreeze after falling below the cloud. Thus wet ice particles can fall through subfreezing air below a supercooled cloud and enhance radar backscattering. While this effect is possible with clouds, the liquid content of fogs is too low to produce more than a few tenths of a degree rise in the temperature of falling ice particles. Furthermore, only cumulus clouds have a sufficient liquid water content to give a 3 degree temperature rise.

MP 2298
KADLUK ICE STRESS MEASUREMENT PROGRAM
Cox, G.F.N.
Technology assessment and research program for offshore minerals operations; 1986 report. Compiled and edited by J.B. Gregory and C.E. Smith
U.S. Dept. of Interior, Minerals Management Service, OCS study MMS 86-0083
[1987] p.100-107
9 refs.
42-1494
Ice loads, Ice pressure, Offshore structures, Caissons, Stresses, Ice conditions, Ice temperature, Wind factors

MP 2299
MECHANICAL PROPERTIES OF MULTI-YEAR PRESSURE RIDGE ICE
Richter-Menge, J.A.
Technology assessment and research program for offshore minerals operations; 1986 report. Compiled and edited by J.B. Gregory and C.E. Smith
U.S. Dept. of Interior, Minerals Management Service, OCS study MMS 86-0083
[1987] p.108-119
19 refs.
42-1495
Ice mechanics, Pressure ridges, Offshore structures, Ice loads, Ice strength, Impact strength, Ice salinity, Ice density, Strain tests, Ice structure, Temperature effects

MP 2300
OF: OVERLAND FLOW WASTEWATER TREATMENT AT EASLEY, S.C.
Martel, C.J. et al
Water Pollution Control Federation. Journal Nov. 1986
p.1078-1079
Discussion of A.R. Abernathy's paper, 41-1899, and author's reply. 5 refs.
42-1609
Jenkins, T.F. Abernathy, A.R.
Waste treatment, Water treatment, Land reclamation, Chemical analysis, Design

MP 2301
EFFECTS OF WATER AND ICE LAYERS ON THE SCATTERING PROPERTIES OF DIFFUSE REFLECTORS
Jezek, K.C. et al
Applied optics Dec. 1, 1987 26(23)
p.5143-5147
7 refs.
42-1651
Koh, G.
Ice optics, Reflectivity, Scattering, Diffusion

MP 2302
PROCEEDINGS
International Symposium on Cold Regions Heat Transfer, Edmonton, Alta., June 4-6, 1987
New York, American Society of Mechanical Engineers, 1987 270p.
Refs. passim. For selected papers see 42-1699 through 42-1715.
42-1688
Cheng, K.C. ed Lunardini, V.J. ed Seki, N. ed
Heat transfer, Ice formation, Ice melting, Soil freezing, Icing, Frost heave, Phase transformations, Ice water interface, Snow melting, Cold weather construction, Mathematical models

MP 2303
EVOLUTION OF FRAZIL ICE IN RIVERS AND STREAMS: RESEARCH AND CONTROL
Daly, S.F.
International Symposium on Cold Regions Heat Transfer, Edmonton, Alta., June 4-6, 1987. Proceedings. Edited by K.C. Cheng, V.J. Lunardini and N. Seki
New York, American Society of Mechanical Engineers, 1987 p.11-16
35 refs.
42-1690
Frazil ice, Ice control, Turbulent flow, Ice formation, Streams, Freezeup, Heat transfer, Ice crystals, River ice, Ice physics, Ice mechanics
This paper presents a selective overview of the research into frazil ice. The development of theory, instrumentation, and control structures has not proceeded on parallel course for all stages of frazil evolution. The earliest, dynamic stage of frazil formation is probably the best described, yet there has been no application of this theory to a practical situation. A fundamental understanding of frazil formation could lead to means of disrupting the formation, such as by artificial seedings, modification of the fluid turbulence, etc. The development of instrumentation, has increased our ability to view and sample frazil, but as yet has not provided much benefit for the design and siting of ice control structures. To date, the successful use of ice control structures relies heavily on the insight of experienced field engineers. Theory or instrumentation has not made their job easier, but the potential is there. A major task now is the synthesis of existing theory and instrumentation for application to ice control.

MP 2304
SOME ANALYTICAL METHODS FOR CONDUCTION HEAT TRANSFER WITH FREEZING/THAWING
Lunardini, V.J.
International Symposium on Cold Regions Heat Transfer, Edmonton, Alta., June 4-6, 1987. Proceedings. Edited by K.C. Cheng, V.J. Lunardini and N. Seki
New York, American Society of Mechanical Engineers, 1987 p.55-64
Refs. 61-64.
42-1695
Heat transfer, Freezing, Thawing, Heat balance, Phase transformations, Soil freezing, Permafrost, Freeze thaw cycles, Analysis (mathematics)
One of the most difficult and yet most interesting areas of heat transfer is conduction (or convection) with freezing or thawing. The inherent non-linearity of the problem along with the unknown moving interface precludes exact solutions for most practical cases. This has spurred great effort to devise approximate solution methods which are accurate and of general application. Many of the known exact solutions are listed here along with a brief discussion of two approximate methods: the quasi-static and the heat balance integral. Space limitations rule out the inclusions of such useful variational methods as that of Biot or of a treatment in more detail.

MP 2305
MODELLING TRASH RACK FREEZEUP BY FRAZIL ICE
Daly, S.F.
International Symposium on Cold Regions Heat Transfer, Edmonton, Alta., June 4-6, 1987. Proceedings. Edited by K.C. Cheng, V.J. Lunardini and N. Seki
New York, American Society of Mechanical Engineers, 1987 p.101-105
10 refs.
42-1700
Freezeup, Frazil ice, Ice solid interface, Ice adhesion, Heat transfer, Ice formation, Mathematical models, Drainage
The freezeup of trash racks by frazil ice occurs in a sequence that has not been quantitatively described. Because of the difficulty in observation and measurement, very little is quantitatively known about the concentration of frazil ice at the intake, the mechanism(s) of underwater ice adhesion, the deposition efficiency of frazil ice, the contribution of different heat transfer modes to the ice growth on the rack, and the relationship of the heat loss through the rack to the flow velocity as a function of the mass of ice present. A comparison of the ice generation by conduction and convection with the mass of ice deposited on the rack from the flow indicates that deposition is the most significant mode of ice formation on the rack. Based on this, and other assumptions, a first generation mathematical model that describes the heat loss through a trash rack during freezeup is developed. The mathematical model is developed for the case of a trash rack through which a constant discharge is maintained. The model is applied to laboratory data with good results. The laboratory data were obtained by modelling a section of a trash rack in a flume located in a cold room. Frazil ice produced in the flume caused the rack to freeze up while a constant discharge was maintained. The mathematical model can be used to suggest means, both structural and operational, of extending the time until total freezeup of a trash rack occurs. Improvements in the mathematical model are suggested.

MP 2306
ARCTIC RESEARCH OF THE UNITED STATES, VOL.1
U.S. Interagency Arctic Research Policy Committee
Washington, D.C., Fall 1987 121p.
42-1746
Bowen, S.L. ed Valliere, D.R. ed
Research projects, Polar regions, Research projects
This new journal provides an overview of Federally funded research activities in Arctic regions and includes brief commentaries on specific programs being pursued by twelve departmental-level groups and thirteen sub-groups. The range of research topics includes minerals, geology, wildlife, land, parks, mines, atmosphere, oceans, biology, glaciology, earth sciences, sea ice, snow, ice, Arctic engineering, medicine, fisheries, weather forecasting, tsunamis, ice edge, remote sensing, space plasma physics, permafrost, hydrology, tundra ecosystems, health, human services, cultural dynamics, archeology, ice breaking, iceberg reconnaissance, Arctic pollution, marine transportation, environmental protection, international Arctic coordination, forestry, soil conservation. Reports of meetings of the various committees and commissions involved in Arctic research, the Arctic Research and Policy Act of 1984, and Executive Order 12501 establishing the Arctic Research Commission and the Interagency Arctic Research Policy Committee are included.

MP 2307
OBSERVATIONS OF JOKULHLAUPS FROM ICE-DAMMED STRANDLINE LAKE, ALASKA: IMPLICATIONS FOR PALEOHYDROLOGY
Sturm, M. et al
Binghamton Symposia in Geomorphology: International series, No.18
Catastrophic flooding. Edited by L. Mayer and D. Nash
London, Allen and Unwin, 1987 p.79-94
14 refs.
42-1613
Beget, J. Benson, C.
Flooding, Ice jams, Glacial lakes, Subglacial drainage, Glacial hydrology, Volume, Hydrography, Paleoclimatology, United States--Alaska--Strandline Lake

MP 2308
DC RESISTIVITY MEASUREMENTS OF MODEL SALINE ICE SHEETS
Arcone, S.A.
IEEE transactions on geoscience and remote sensing
Nov. 1987, GE-25(6)
p.845-849
16 refs.
42-1754
Ice electrical properties, Electrical resistivity, Salt ice

MP 2309
ENVIRONMENTAL FACTORS AND STANDARDS FOR ATMOSPHERIC OBSCURANTS, CLIMATE AND TERRAIN
Opitz, R.K. et al
AirLand Battlefield Environment Executive Committee, Environmental Standards for Materiel Design Group, Oct. 1987 137p.
7 refs. First edition. ALBE report 1, ESMDG pamphlet.
42-3145
Miers, R.T. Smirkey, R.C. Bates, R.E. Robinson, J.H. West, H.W.
Military operation, Snow loads, Environments, Icing, Visibility, Ice fog, Sound waves, Freeze thaw cycles, Topographic features, Climatic factors, Military facilities

MP 2310
HEAT LOSSES FROM THE CENTRAL HEAT DISTRIBUTION SYSTEM AT FORT WAINWRIGHT
Phetteplace, G.E.
Canada. Environmental Protection Service. Water Pollution Control Directorate. Economic and technical review report Dec. 1982 EPS 3-WP-62-6
Symposium on Utilities Delivery in Cold Regions, 3rd, Edmonton, Alta., May 25-26, 1982. Proceedings. Compiled by D.W. Smith
p.303-323
5 refs.
42-1728
Heat loss, Heating, Utilities, Underground pipelines, Air temperature, Temperature effects, Analysis (mathematics), Computer programs, Soil temperature, Seasonal variations

MP 2311
STRAIN-RATE AND GRAIN-SIZE EFFECTS IN ICE
Cole, D.M.
Journal of glaciology 1987 33(115)
p.274-280
22 refs.
42-1822
Ice deformation, Ice crystal structure, Strains, Grain size, Tests, Stress strain diagrams
This paper presents and discusses the results of constant deformation-rate tests on laboratory-prepared polycrystalline ice. Strain-rates ranged from 0.000,000,1 to 0.1/s, grain-size ranged from 1.5 to 5.8 mm, and the test temperature was -5 C. At strain-rates between 0.000,000,1 and 0.001/s, the stress-strain-rate relationship followed a power law with an exponent of n=4.3 calculated without regard to grain-size. However, a reversal in the grain-size effect was observed: below a transition point near 0.000,004/s the peak stress increased grain-size, while above the transition point the peak stress decreased with increasing grain-size. This latter trend persisted to the highest strain-rates observed. At strain-rates above 0.001/s the peak stress became independent of strain-rate. The unusual trends exhibited at the lower strain-rates are attributed to the influence of the grain-size on the balance of the operative deformation mechanisms. Dynamic recrystallization appears to intervene in the case of the finer-grained material and serves to lower the peak stress. At comparable strain-rates, however, the large-grained material still experiences internal micro-fracturing, and thin sections reveal extensive deformation in the grain-boundary regions that is quite unlike the appearance of the strain-induced boundary migration characteristic of the fine-grained material.

MP 2312
AIRBORNE RIVER-ICE THICKNESS PROFILING WITH HELICOPTER-BORNE UHF SHORT-PULSE RADAR
Arcone, S.A. et al
Journal of glaciology 1987 33(115)
p.330-340
14 refs.
42-1830
Delaney, A.J.
River ice, Ice cover thickness, Scattering, Remote sensing, Profiles, Equipment, Lake ice, Surface roughness, Frazil ice
The ice-thickness profiling performance of a helicopter-mounted short-pulse radar operating at approximate center frequencies of 600 and 900 MHz was assessed. The antenna packages were mounted 1.2 m off the skid of a small helicopter whose speed and altitude were varied from about 1.8 to 9 m/s and 3 to 12 m. Clutter from the helicopter offered minimal interference with the ice data. Data were acquired in Alaska over lakes (as a proving exercise) and two rivers, whose conditions varied from open water to over 1.5 m of solid ice with numerous frazil-ice formations. The most readily interpretable data were acquired when the ice or snow surface was smooth. Detailed surface investigations on the Tanana River revealed good correlations of echo delay with solid ice depth, but an insensitivity to frazil-ice depth due to its high water content. On the Yukon River, coinciding temporally coherent surface and bottom reflections were associated with solid ice and smooth surfaces. All cases of incoherent surface returns (scatter) occurred over ice rubble. Rough-surface scattering was always followed by the appearance of bottom scattering but, in many cases, including a hanging-wall formation of solid frazil ice, bottom scattering occurred beneath coherent, smooth-surface reflections. Areas of incoherent bottom scattering investigated by drilling revealed highly variable ice conditions, including frazil ice. The minimum ice thickness that could be resolved from the raw data was about 0.2 m with the 600 MHz antenna and less than 0.15 m with the 900 MHz antenna.

MP 2313
RATING SYSTEM FOR UNSURFACED ROADS TO BE USED IN MAINTENANCE MANAGEMENT
Eaton, R.A. et al
North American Conference on Managing Pavements, 2nd, Toronto, Ontario, Nov. 2-6, 1987. Proceedings, Vol.2 [1987] p.(2)51-(2)62
24 refs.

42-1879

Gerard, S. Dattilo, R.S.
Road maintenance, Pavements, Drainage, Surface properties
A system has been developed and field validated for rating unsurfaced roads. The number obtained for each road by using this system can be used to prioritize or compare road conditions to develop a maintenance program. This unsurfaced road rating system can be used by itself or to supplement current pavement management systems.

MP 2314
ICE THICKNESS DISTRIBUTION ACROSS THE ATLANTIC SECTOR OF THE ANTARCTIC OCEAN IN MIDWINTER
Wadhams, P. et al
Journal of geophysical research Dec. 15, 1987 92(C13) p.14,535-14,552
9 refs.

42-1935

Lange, M.A. Ackley, S.F.
Ice cover thickness, Sea ice, Ice floes, Photography
The entire width of the antarctic sea ice zone was traversed in the vicinity of 0 deg longitude from July 18 to Sep. 10, 1986. Ice thicknesses were measured by direct drilling, by helicopter profiling using an Exstar 100-MHz impulse radar system and by aerial photography. The results of the point measurements (drilling) are reported in this paper together with an indication of how the radar and photography data will be used to extend them so as to yield area-averaged ice thickness distributions. The main ice type across the entire width of the ice cover was consolidated pancake ice occurring in vast floes; this formed out of a 250-km-wide band at the advancing ice edge which comprised a concentrated field of individual pancakes in a matrix of frazil ice. Preferred thicknesses of undeformed floes were 40-60 cm of ice covered with 5-15 cm of snow. The individual pancakes attained almost all of this thickness before consolidation; subsequent congelation growth was slow, estimated at 0.4 cm/d. The floes contained much small-scale roughness on the upper and lower surfaces due to rafting of pancakes at the time of consolidation, but pressure ridging was modest except in the far south. A few very thick (3-11 m) multiyear floes were observed embedded in the pack at latitudes beyond 55S. (Auth.)

MP 2316
HISTORY OF SNOW-COVER RESEARCH
Colbeck, S.C.
Journal of glaciology 1987 Special issue p.60-65
31 refs.

42-1959

Snow cover, Snow hydrology, Avalanches, History
The history of snow-cover research is divided into 4 distinct periods. Before 1930 there were systematic observations of snow but the tools were just being developed to begin serious research. From 1930 to 1936, many investigations were made because of the practical considerations of snow hydrology and snow avalanches. Individuals began the assessment of snow water equivalent for forecasting run-off and the observation of snow structure and texture. Quantitative and physical investigations quickened after government-sponsored laboratories were established in 1936, the same year as the founding of the International Glaciological Society. From 1935 through the 1960s, many detailed investigations were made into snow's physical properties and behavior. Professional societies organized national and regional meetings, and published the results of snow research. Many more laboratories became involved as knowledge about snow was developed and applied to run-off forecasting and avalanche defense. Snow research surged again during the 1970s with the establishment of a new generation of snow scientists using more advanced theory, computers, and instrumentation. As demands continue for solutions to snow problems with new emphasis on old themes, snow research generates knowledge about snow for a wide variety of applications.

MP 2317
PROCEEDINGS, VOL.4
International Conference on Offshore Mechanics and Arctic Engineering, 7th, Houston, TX, Feb. 7-12, 1988
New York, American Society of Mechanical Engineers, 1988 348p.
Refs. passim. For individual papers see 42-2077 through 42-2119.

42-2076

Sodhi, D.S. ed Luk, C.H. ed Sinha, N.K. ed
Offshore structures, Ice loads, Ice mechanics, Ice physics, Engineering, Meetings, Sea ice, Ice conditions, Icebreakers

MP 2318
FLEXURE AND FRACTURE OF MACROCRYSTALLINE S1 TYPE FRESHWATER ICE
Dempsey, J.P. et al
International Conference on Offshore Mechanics and Arctic Engineering, 7th, Houston, TX, Feb. 7-12, 1988. Proceedings, Vol.4. Edited by D.S. Sodhi, C.H. Luk and N.K. Sinha
New York, American Society of Mechanical Engineers, 1988 p.39-46
31 refs.

42-2082

Nigam, D. Cole, D.M.
Ice strength, Flexural strength, Fracturing, Ice crystal structure, Ice loads, Grain size, Ice cracks
The four-point-bend loading configuration is used here to study the flexural strength and fracture toughness of macrocrystalline S1 type freshwater ice. The emphasis in this investigation was to minimize testing errors, prepare geometrically similar specimens milled to good accuracy, and to use a mechanical and repeatable method of notch formation. The question under study is: Would a wide scatter in flexural strengths and fracture toughness results still occur in S1 ice if the inaccuracies in specimen preparation and variations in notch acuity were minimized, and if the specimen size were increased significantly? The basic tenet then is that any scatter would be predominantly due to crystal orientation effects, grain size effects, variations in the predominant c-axis orientations, as well as both specimen size and specimen geometry.

MP 2319
GROWTH OF EG/AD/S MODEL ICE IN A SMALL TANK
Borland, S.L.
International Conference on Offshore Mechanics and Arctic Engineering, 7th, Houston, TX, Feb. 7-12, 1988. Proceedings, Vol.4. Edited by D.S. Sodhi, C.H. Luk and N.K. Sinha
New York, American Society of Mechanical Engineers, 1988 p.47-53
9 refs.

42-2083

Ice models, Ice strength, Flexural strength, Ice elasticity, Solutions, Freezing, Ice mechanics, Tests, Ice growth, Ice sheets, Tanks (containers)
A new type of refrigerated model ice was tested for flexural strength and elasticity in a small basin. This model ice, termed "EG/AD/S" ice by the developer, Timco of NRCC, is produced by freezing a solution of three chemicals--ethylene glycol, aliphatic detergent, and sucrose. A small-scale laboratory investigation was conducted to determine some of the mechanical properties of the EG/AD/S ice and to make modifications to the chemical formula as needed. The results of these tests were found to compare well with Timco's results for EG/AD/S ice as well as with tests on urea ice grown in the same tank. Described are some of the problems with this new ice, including excessive sudsing and bacterial blooms, and the techniques used to try to alleviate them. Also discussed are several unique aspects of dealing with ice sheet growth and mechanical properties testing in a small tank.

MP 2320
HEAT TRANSFER PERFORMANCE OF COMMERCIAL THERMOSYPHONS WITH INCLINED EVAPORATOR SECTIONS
Haynes, F.D. et al
International Conference on Offshore Mechanics and Arctic Engineering, 7th, Houston, TX, Feb. 7-12, 1988. Proceedings, Vol.4. Edited by D.S. Sodhi, C.H. Luk and N.K. Sinha
New York, American Society of Mechanical Engineers, 1988 p.275-280
14 refs.

42-2110

Zarling, J.P.
Permafrost beneath structures, Heat transfer, Subgrades, Wind tunnels, Measuring instruments, Wind velocity, Tests, Evaporation, Equipment, Thermosyphons
Laboratory tests have been conducted with two full-size, two-phase commercial thermosyphons in an atmospheric wind tunnel at the U.S. Army CRREL. The test variables were wind speed and evaporator inclination angle. The air speed ranged from 0 to 5.2 m/s. The evaporator angles were varied from 0 to 12 deg measured from the horizontal. The effect of nearby walls on thermosyphon performance was also investigated. Tests were conducted with walls oriented parallel, at 45 deg and at right angles to the air flow direction. The air temperature for all tests was about -13 C. Test results are presented with thermal conductance of the thermosyphon as a function of wind speed and evaporator inclination angle. The heat transfer conductance was found to increase with increasing wind speed and increasing evaporator inclination angle.

MP 2321
ON THE APPLICATION OF THERMOSYPHONS IN COLD REGIONS
Zarling, J.P. et al
International Conference on Offshore Mechanics and Arctic Engineering, 7th, Houston, TX, Feb. 7-12, 1988. Proceedings, Vol.4. Edited by D.S. Sodhi, C.H. Luk and N.K. Sinha
New York, American Society of Mechanical Engineers, 1988 p.281-286
14 refs.

42-2111

Haynes, F.D. Daly, S.F.
Low temperature tests, Heat transfer, Wind velocity, Temperature effects, Equipment, Water flow, Ice growth, Measuring instruments, Thermosyphons
The exposure of portable electronic data logging equipment to extreme low temperatures usually leads to system failure. To overcome this difficulty at northern remote sites, the use of a thermosyphon to transfer energy stored in the ground to an insulated instrument shelter was tested. The results of the test showed that the thermosyphon maintained the instrument shelter well above the outdoor ambient air temperature during cold spells. Laboratory tests were conducted with two-phase full-size thermosyphons [illegible] water in a [illegible]. The test variables were wind speed and water [illegible]. A single-phase thermosyphon was also [illegible] growing ice. The heat transfer conductance of the thermosyphon [illegible] estimated for various wind speeds. The use of thermosyphons placed in rivers has been proposed to collect transported frazil ice to augment [illegible] formation or prevent frazil ice from interfering with downstream hydraulic structures. Laboratory [illegible] were conducted with model two-phase thermosyphons [illegible] refrigerated flume to test this concept. [illegible] was generated [illegible] of a thermosyphon array [illegible] across the flume [illegible] to the flow. The ability to collect [illegible] was determined by measuring [illegible] the array with time. [illegible] with [illegible] [illegible] thermosyphons [illegible] [illegible] also investigated.

MP 2322
POLAR COMMUNICATIONS: STATUS AND RECOMMENDATIONS. REPORT OF THE SCIENCE WORKING GROUP
Rosenberg, T.J. ed
Greenbelt, MD, U.S. National Aeronautics and Space Administration, Dec. 1987 29p.
3 refs.

42-2146

Jezek, K.C. ed
Spacecraft, Telecommunication, Design, Polar regions, Glaciology, Oceanography, Meteorology, Geophysics
This report summarizes the capabilities of existing communication links within the polar regions, as well as between the polar regions and the continental United States. The report places these capabilities in the context of the objectives of principal scientific disciplines active in polar research and, in particular, of how discipline scientists both utilize and are limited by present technologies. Based on an assessment of the scientific objectives potentially achievable with improved communication capabilities, the report concludes with a list of requirements on and recommendations for communication capabilities necessary to support polar science over the next ten years. (Auth.)

MP 2323
NEW APPROACH FOR SIZING RAPID INFILTRATION SYSTEMS
Martel, C.J.
Journal of environmental engineering Feb. 1988 114(1) p.211-215
13 refs.

42-2246

Waste treatment, Water treatment, Seepage

MP 2324
ON THE DETERMINATION OF THE AVERAGE YOUNG'S MODULUS FOR A FLOATING ICE COVER
Kerr, A.D. et al
Cold regions science and technology Feb. 1988 15(1) p.39-43
11 refs.

42-2287

Haynes, F.D.
Floating ice, Loads (forces), Ice elasticity, Analysis (mathematics), Pressure
First, the meaning of Young's modulus for a floating ice cover is discussed. A method often used for determining the average modulus of the cover, E(av), consisting of loading an ice cover vertically with a rigid disc, is then presented and a possible shortcoming of the calculation method used is pointed out. It is related to the fact that the contact pressure distribution between disc and ice cover is generally not known. To clarify this issue, a comparative study was conducted to establish the effect of related pressure distributions on the calculated E(av)-value. It was found that the limiting cases--like the uniformly distributed pressure and the uniform line distribution along the disc boundary--yield E(av) that are close to each other. Also, for the range of parameters under consideration, the E(av) obtained using the solution for a concentrated force is close. The paper concludes by showing how the [illegible] graphs may be used to simplify the calculation of E(av) for [illegible] [illegible].

MP 2325
[illegible] NUCLEATION IN POLYCRYSTALLINE ICE
[illegible]

42-22[illegible]

[illegible]

MP 2326
SNOW MASS CONCENTRATION AND PRECIPITATION RATE
Koh, G. et al
Cold regions science and technology Feb. 1988 15(1)
p.89-92
7 refs.
42-2293
Lacombe, J. Hutt, D.L.
Snow accumulation, Precipitation gages, Snowfall, Measuring instruments, Velocity

MP 2327
MEASURED INSULATION IMPROVEMENT POTENTIAL FOR THE U.S. ARMY BUILDINGS
Flanders, S.N.
American Society for Testing and Materials. Special technical publication 1987 No.922
Thermal insulation: materials and systems. A conference sponsored by ASTM Committee C-16 on Thermal Insulation, Dallas, TX, 2-6 Dec. 1984. [Proceedings]. Edited by F.J. Powell and S.L. Matthews
p.202-220
5 refs.
42-2412
Thermal insulation, Buildings, Heat transfer, Military facilities, Convection, Heat flux, Accuracy, Economic analysis, Thermal conductivity
As-built drawings and handbook calculations of R values are often inadequate bases for investment decisions regarding improved insulation of U.S. Army buildings. Reported field and laboratory experience indicates that a technique employing surface-mounted heat flux sensors (HFSs) in conjunction with infrared thermography (IRT) can yield reliable estimates of R values. This technique employs IRT to position HFSs and thermocouples at representative locations on walls and roofs or attics to acquire heat flow and temperature data for estimating R values. This paper reports on the application of this technique at Ft. Carson, Colorado, and Ft. Richardson, Alaska, to 8 family housing units, a temporary office building, and a barracks. Infrared thermography of these buildings detected few thermal anomalies, but measurement of several walls with HFSs and thermocouples (typically at 5 locations spaced vertically on each wall) revealed significant variation in estimated R values; this variation is attributable to convection, even within fully insulated walls. This is significant for proper placement of sensors and indicates that installed fibrous insulation can lack the ability to quell convection. The insulating ability of walls containing poorly installed mineral fiber batt insulation was much worse than would be indicated by the design handbook values. Some attic insulation performed exactly as expected; some was at least 40% worse than expected.

MP 2328
EVALUATION OF DISPOSABLE MEMBRANE FILTER UNITS FOR SORPTIVE LOSSES AND SAMPLE CONTAMINATION
Walsh, M.E. et al
Environmental technology letters 1986 Vol.9
p.45-52
13 refs.
42-2494
Knapp, L.K. Jenkins, T.F.
Filters, Sampling

MP 2329
SHAPE OF CREEP CURVES IN FROZEN SOILS AND POLYCRYSTALLINE ICE
Fish, A.M.
Canadian geotechnical journal Nov. 1987 24(4)
p.623-629
12 refs.
42-2497
Soil creep, Ice creep, Frozen ground mechanics, Ice mechanics, Rheology, Mathematical models, Stresses, Temperature effects
A new method was developed for determining creep parameters, particularly the time to failure, from a single linear plot in which an individual creep curve forms a straight line for primary and tertiary creep. Secondary creep is considered to be a principal point on this line that predetermines the onset of failure. The times to failure can be predicted, even when creep tests are not complete, by extrapolating information obtained for primary creep. Based upon T.H. Jacka's test data, prediction of creep strain was evaluated using the constitutive equation of A.M. Fish for entire creep and compared with the modified Sinha equation of M.F. Ashby and P. Duval for attenuating creep as well as with models for primary and secondary creep. It is shown that the shape of the creep curves, and thus the creep parameters, varies with stress, temperature, and other factors. Hence, a family of creep curves cannot be described by a constitutive equation with a single set of creep parameters that do not take into account these variations without loss in the accuracy of the creep strain calculations.

MP 2330
MODELING THE ELECTROMAGNETIC PROPERTY TRENDS IN SEA ICE; PART 1
Kovacs, A. et al
Cold regions science and technology Oct. 1987 14(3)
p.207-235
33 refs.
42-2559
Morey, R.M. Cox, G.F.N.
Ice physics, Electromagnetic properties, Sea ice, Dielectric properties, Mathematical models, Electrical resistivity, Ice cover thickness, Pressure ridges, Brines

MP 2331
CAMP CENTURY SURVEY 1986
Gundestrup, N.S. et al
Cold regions science and technology Oct. 1987 14(3)
p.281-288
24 refs.
42-2564
Clausen, H.B. Hansen, B.L. Rand, J.
Boreholes, Surface migration, Remote sensing, Ice mechanics, Velocity, Topographic features, Drilling, Greenland--Camp Century
Directional surveys of the bore-hole at Camp Century, Greenland were made in 1966, 1967 and 1969. From these surveys a surface velocity of 5.5 m/yr in the direction 240 deg was computed. The position of the 60 m meteorological tower near the bore-hole was measured in 1977 and 1986 with satellite navigation equipment. These measurements show a surface velocity of 3.5 m/yr in the direction 235 deg. Measurement of the surface topography in 1986 shows the bore-hole is situated on a local sloping ice divide. A differential magnetometer was used to locate the drill tower. Hand augering verified the location and showed the drill tower was buried 6.5 to 7 m beneath the 1986 snow surface, as expected from the depth-age relation. The casing was not identified. Extension of the casing to the snow surface and resurvey of the bore-hole will provide urgently needed information on the variation of ice flow with depth.

MP 2332
AIRBORNE ELECTROMAGNETIC SOUNDING OF SEA ICE THICKNESS AND SUB-ICE BATHYMETRY
Kovacs, A. et al
Cold regions science and technology Oct. 1987 14(3)
p.289-311
For another source see 42-2551. 21 refs.
42-2565
Valleau, N.C. Holladay, J.S.
Ice cover thickness, Subglacial observations, Electromagnetic prospecting, Airborne radar, Snow cover thickness, Ice conditions, Sounding, Sea ice, Profiles, United States--Alaska--Prudhoe Bay
A study was made in May 1985 to determine the feasibility of using an airborne electromagnetic sounding system for profiling sea ice thickness and the sub-ice water depth and conductivity. The study was made in the area of Prudhoe Bay, Alaska. The multifrequency airborne electromagnetic sounding system consisted of control and recording electronics and an antenna. The electronics module was installed in a helicopter, and the 7 m long tubular antenna was towed beneath the helicopter at about 35 m above the ice surface. For this electromagnetic system, both first-year and second-year sea ice could be profiled, but the resolution of ice thickness decreased as the ice became rough. This decrease was associated with the large footprint of the system, which effectively smoothed out the sea ice relief. Under-ice water depth was determined, as was seawater conductivity. The results of the feasibility study were encouraging, and further system development is therefore warranted.

MP 2333
SINGLE-HORN REFLECTOMETRY FOR IN SITU DIELECTRIC MEASUREMENTS AT MICROWAVE FREQUENCIES
Arcone, S.A. et al
IEEE transactions on geoscience and remote sensing Jan. 1988 26(1)
p.89-92
10 refs.
42-2803
Larson, R.W.
Dielectric properties, Reflectivity, Remote sensing, Ice physics

MP 2334
LIQUID SAMPLER
Rand, J.H.
U.S. Patent Office. Patent Aug. 31, 1982
4 col.
USP-4,346,612
10 refs.
42-2607
Unfrozen water content, Frazil ice, Samplers, Measuring instruments, Design

MP 2335
COLLAPSIBLE RESTRAINT FOR MEASURING TAPES
Ueda, H.T.
U.S. Patent Office. Patent Mar. 8, 1983
12 col.
USP-4,375,721
13 refs.
42-2608
Ice cover thickness, Measuring instruments, Boreholes, Design

MP 2336
ONSHORE ICE PILE-UP AND RIDE-UP: OBSERVATIONS AND THEORETICAL ASSESSMENT
Kovacs, A. et al
Arctic coastal processes and slope protection design. Edited by A.T. Chen and C.B. Leidersdorf
New York, American Society of Civil Engineers, 1988
p.108-142
Refs. p.138-142.
42-2988
Sodhi, D.S.
Fast ice, Ice pileup, Ice override, Ice loads, Ocean currents, Wind factors, Seasonal variations, Ice sheets, Pressure ridges
An overview of shore ice pile-up and ride-up observations is presented and the forces associated with ice rubble formation are discussed. Historical and recent observations indicate that the onshore movement of ice is generally a spring or fall event associated with wind and/or water driving forces. The occurrence of this phenomenon is relatively unpredictable and has resulted in the destruction of structures and loss of life. The analytical and experimental work undertaken to date tends to show that low driving forces per unit width can cause shore ice pile-up or ride-up, but that high concentrated forces can occur during such events along local areas of resistance. An analysis of the ice sheet failure process is given which indicates that the average ice rubble building force per unit width is a function of rubble height, to a power between 1 and 2, depending on the total ice sheet width undergoing failure.

MP 2337
WETTING OF POLYSTYRENE AND URETHANE ROOF INSULATIONS IN THE LABORATORY AND ON A PROTECTED MEMBRANE ROOF
Tobiasson, W. et al
Journal of thermal insulation Oct. 1987 11(2)
p.108-119
13 refs. For another source see 42-2926.
42-3182
Greatorex, A. Van Pelt, D.
Roofs, Insulation, Cellular plastics

MP 2338
RADIOGLACIOLOGY BY V.V. BOGORODSKII, ET AL.
Jezek, K.C.
American Meteorological Society. Bulletin Jan. 1988 69(1)
p.55-56
Book review. For the book being reviewed see 40-1650.
42-3070
Glacier ice, Airborne radar, Radar echoes, Glaciology, Photointerpretation, Geophysical surveys, Ice physics

MP 2339
KINETIC FRICTION OF SNOW
Colbeck, S.C.
Journal of glaciology 1988 34(116)
p.78-86
18 refs.
42-3334
Metal snow friction, Water films, Snow cover, Snow melting, Grain size, Temperature effects, Velocity, Shear strength, Friction, Analysis (mathematics)
Three components of the kinetic friction of snow are described but only the lubricated component of friction is treated in detail. This component depends upon the thickness of water films which support a slider on snow grains over a small fraction of its area. The thickness of the film decreases with ambient temperature in a manner which is sensitive to the thermal conductivity of the slider. The minimum value of friction at any temperature is reached at an intermediate value of speed because friction decreases as the slider first begins to move and the films form but then increases at higher speeds because of the shear resistance. At sub-freezing temperatures a small area in the front part of the slider is dry and the friction is high. Once the water film is formed it increases in thickness towards an equilibrium value which can be very sensitive to slider properties, speed, and temperature. It appears that the mechanisms may be very different for hydrophobic and hydrophilic sliders. From the equations derived here it is clear why friction decreases with repeated passes over the same snow.

MP 2340
WOOD-FRAME ROOFS AND MOISTURE
Tobiasson, W.
[illegible] Mar. 1988 3(3)
p.33-3[illegible]
42-3347
[illegible], Moisture, Wooden structures

MP 2342
GLACIOLOGICAL INVESTIGATIONS USING THE SYNTHETIC APERTURE RADAR IMAGING SYSTEM
Bindschadler, R.A. et al
Annals of glaciology 1987 Vol.9
Symposium on Remote Sensing in Glaciology, 2nd, Cambridge, Sep. 8-9 and 11-12, 1986. Proceedings
p.11-19
19 refs.
41-4428
Jezek, K.C. Crawford, J.
Ice sheets, Remote sensing, Glaciology, Airborne radar, Ice surface, Ice creep, Crevasses, Icebergs, Lake ice, River ice, LANDSAT, Greenland
Numerous examples of synthetic aperture radar (SAR) imagery of ice sheets are shown and prominent features of glaciological importance which appear in the images are discussed. Features which can be identified include surface undulations, ice-flow lines, crevasses, icebergs, lakes, and streams (even lakes and streams which are inactive or covered by snow), and possibly, the extent of the ablation and wet snow zones. SAR images presented here include both L-band data from the Seasat satellite and X-band data from an airborne radar. These two data sets overlap at a part of eastern Greenland where a direct comparison can be made between two images. Comparison is also made between SAR and Landsat images in western Greenland. It is concluded that SAR and Landsat are highly complementary instruments; Landsat images contain minimal distortion while SAR's all-weather, day/night capability plus its ability to penetrate snow provide glaciologists with an additional and very powerful tool for research.

MP 2343
RATIONAL DESIGN OF SLUDGE FREEZING BEDS
Martel, C.J.
1988 Joint CSCE-ASCE National Conference on Environmental Engineering, Vancouver, B.C., July 13-15, 1988. Proceedings. Edited by S.C. Liptak, J.W. Atwater and D.S. Mavinic
Montreal, Quebec, Canadian Society for Civil Engineering, 1988 p.575-581
5 refs.
42-3536
Sludges, Waste treatment, Water treatment, Freezing, Dewatering, Freeze thaw cycles, Ice crystal formation, Impurities
A new unit operation for sludge dewatering called a freezing bed is described. This operation uses the natural seasonal temperature changes in cold regions to freeze and thaw the sludge. Equations for predicting the design depth of the bed are presented along with an example of how they can be used.

MP 2344
ALASKA SAR FACILITY
Weeks, W.F. et al
International Conference on Port and Ocean Engineering under Arctic Conditions, 9th, Fairbanks, AK, Aug. 17-22, 1987. Proceedings, Vol.1. Edited by W.M. Sackinger and M.O. Jeffries. (Port and ocean engineering under Arctic conditions)
Fairbanks, University of Alaska, Geophysical Institute, 1988 p.103-110
16 refs.
42-3549
Ice water interface, Remote sensing, Drift, Airborne radar, Ice mechanics, Sea ice
A short description is given of the general characteristics of the ice/ocean and applications demonstrations research programs that are anticipated as part of the Alaskan SAR Facility (ASF) program. Also described are the characteristics of the three satellite SAR (Synthetic Aperture Radar) systems that will supply data to the ASF and the design and analysis capabilities of the different components of the ground station.

MP 2345
AIRBORNE MEASUREMENT OF SEA ICE THICKNESS AND SUBICE BATHYMETRY
Kovacs, A. et al
International Conference on Port and Ocean Engineering under Arctic Conditions, 9th, Fairbanks, AK, Aug. 17-22, 1987. Proceedings, Vol.1. Edited by W.M. Sackinger and M.O. Jeffries. (Port and ocean engineering under Arctic conditions)
Fairbanks, University of Alaska, Geophysical Institute, 1988 p.111-120
8 refs.
42-3550
Valleau, N.C.
Ice cover thickness, Airborne equipment, Electromagnetic prospecting, Sounding, Sea ice, Profiles
A pilot study was made in May 1985 to determine the feasibility of using an airborne electromagnetic sounding system for profiling sea ice thickness and the subice water depth and conductivity. The study was made in the area of Prudhoe Bay, Alaska. The multi-frequency airborne electromagnetic sounding system consisted of control and recording electronics and an antenna. The electronics module was installed in a helicopter and the 7-m-long tubular antenna was towed, beneath a helicopter, at about 35 m above the ice surface. Examples of the profiling results are presented; they indicate that, for the electromagnetic system used, both first-year and second-year sea ice could be profiled, but the resolution decreased as the ice became rough. This decrease was associated with the large footprint of the system, which effectively smoothed out the sea ice relief. Under-ice water depth was determined, as was seawater conductivity. The results of the feasibility study were considered highly encouraging and further system development is therefore warranted.

MP 2346
ELECTROMAGNETIC MEASUREMENTS OF A SECOND-YEAR SEA ICE FLOE
Kovacs, A. et al
International Conference on Port and Ocean Engineering under Arctic Conditions, 9th, Fairbanks, AK, Aug. 17-22, 1987. Proceedings, Vol.1. Edited by W.M. Sackinger and M.O. Jeffries. (Port and ocean engineering under Arctic conditions)
Fairbanks, University of Alaska, Geophysical Institute, 1988 p.121-136
7 refs.
42-3551
Morey, R.M.
Ice floes, Electromagnetic prospecting, Sea ice, Ice cover thickness, Dielectric properties, Brines, Attenuation
"Impulse" radar and ice property data were obtained on a second-year sea ice floe. These data were used to develop a relationship for estimating the ice thickness from just the two-way time-of-flight of the impulse radar electromagnetic wavelet traveling from the surface to the ice "bottom" and back to the surface. The relationship developed allows estimation of the thickness of sea ice from about 1 to 5 m, with or without a snow cover. The data revealed that the apparent dielectric constant of sea ice decreased with increasing ice thickness until the thickness reached about 4 m. For sea ice thicker than 4 m, the apparent dielectric constant became relatively constant. With the use of a model for determining the electromagnetic properties of sea ice from its physical properties, as determined from ice cores, the electromagnetic properties were calculated versus depth. The model results were then compared with the electromagnetic properties determined from field measurements. The two results were in good agreement.

MP 2347
EVALUATION OF AN OPERATIONAL ICE FORECASTING MODEL DURING SUMMER
Tucker, W.B. et al
International Conference on Port and Ocean Engineering under Arctic Conditions, 9th, Fairbanks, AK, Aug. 17-22, 1987. Proceedings, Vol.1. Edited by W.M. Sackinger and M.O. Jeffries. (Port and ocean engineering under Arctic conditions)
Fairbanks, University of Alaska, Geophysical Institute, 1988 p.159-174
10 refs.

42-3554

Hibler, W.D., III
Ice forecasting, Drift, Ice conditions, Ice edge, Seasonal variations, Models, Sea ice
The Polar Ice Prediction System (PIPS) is an ice forecasting model run on a daily basis at the U.S. Navy's Fleet Numerical Oceanographic Center (FNOC). The model was originally developed by Hibler (1979) and subsequently modified by Preller (1985) to run on FNOC's Cyber 205. Atmospheric forcing fields are derived from the Naval Operational Global Atmospheric Prediction System (NOGAPS). PIPS is run on a 127-km resolution 47 x 25 grid, which covers the entire Arctic Basin and substantial parts of the Greenland and Norwegian Seas. The system produces forecasts of ice drift, thickness, concentration and divergence at 24-hr intervals out to 144 hr (6 days). Although PIPS is run on a daily basis, the concentration field is initialized weekly using a digitized version of the concentration analysis field prepared by the Naval Polar Oceanography Center at Suitland, Maryland. The system's ability to forecast ice drift, concentration and ice edge location was assessed for the period, from June 15 to October 15, 1986. The PIPS drift predictions were generally excessive, although the predicted drift directions were reasonable. Mean concentration differences between the PIPS forecasts and the analyses were about 12%. Although ice edge location was reasonably predicted in most cases, the model demonstrated a trend of rapid ice retreat in the Chukchi and East Siberian Seas that was unrealistic.

MP 2348
EXPERIMENTAL DETERMINATION OF THE FRACTURE TOUGHNESS OF UREA MODEL ICE
Bentley, D.L. et al
International Conference on Port and Ocean Engineering under Arctic Conditions, 9th, Fairbanks, AK, Aug. 17-22, 1987. Proceedings, Vol.1. Edited by W.M. Sackinger and M.O. Jeffries. (Port and ocean engineering under Arctic conditions)
Fairbanks, University of Alaska, Geophysical Institute, 1988 p.[illegible]
16 refs.

42-3565

Sodhi, D.S. Dempsey, J.P.
Ice cracks, Ice models, Urea, Ice solid interface, Offshore structures, Loads (forces), Fracturing, Experimentation, Ice loads, Ice cover thickness, Flexural strength
The use of different types of model ice in examining ice/structure interactions requires a better understanding of the fracture behavior of these materials in order to accurately interpret the results of model tests. There have been only a limited number of fracture tests performed on model ice. A preliminary experimental study of the fracture toughness of the urea-doped model ice used in the test basin at CRREL has been completed. An "in-situ" wedge-loaded TDCB (tapered double-cantilever-beam) specimen geometry was chosen. An expression for the fracture toughness as a function of applied load, specimen geometry, and ice thickness was developed using a finite element program.

MP 2349
COMPUTER-CONTROLLED DATA ACQUISITION SYSTEM FOR A HYDRAULIC FLUME
Zabilansky, L.J.
International Instrumentation Symposium, 34th, Albuquerque, NM, May 2-6, 1988. Proceedings
Research Triangle Park, NC, Instrument Society of America, 1988 p.453-460
2 refs.

42-3608

Channels (waterways), Ice formation, Frazil ice, Ice mechanics, Temperature effects, Data processing, Ice accretion, Experimentation

MP 2350
COMPARISON OF EXTRACTION TECHNIQUES FOR MUNITIONS RESIDUES IN SOIL
Jenkins, T.F. et al
Analytical chemistry May 1, 1987 59(9) p.1326-1331
23 refs.

42-3737

Grant, C.L.
Soil pollution, Military operation, Soil composition, Chemical analysis, Countermeasures

MP 2353
VERIFICATION TESTS OF THE SURFACE INTEGRAL METHOD FOR CALCULATING STRUCTURAL ICE LOADS
Johnson, J.B. et al
International Conference on Port and Ocean Engineering under Arctic Conditions, 9th, Fairbanks, AK, Aug. 17-22, 1987. Proceedings, Vol.1. Edited by W.M. Sackinger and M.O. Jeffries. (Port and ocean engineering under Arctic conditions)
Fairbanks, University of Alaska, Geophysical Institute, 1988 p.449-456
6 refs.

42-3579

Sodhi, D.S.
Ice loads, Offshore structures, Stresses, Ice cracks, Experimentation, Measuring instruments, Accuracy, Ice sheets
Experiments were conducted to determine the accuracy of calculating ice loads on offshore structures using ice stress measurements and a surface integral method. Biaxially-sensitive stress sensors were installed near an ice sheet edge and a flat plate instrumented indentor was pushed against the ice edge to simulate a distributed load on the boundary of a semi-infinite plate. Two experiments were conducted. The first determined the agreement between stress measurements and calculated results for the corresponding analytic solution and examined the accuracy of the surface integral method. The second examined the influence of cracks in the ice sheet on the accuracy of the surface integral method. The measured ice stresses were of the same order but less than those calculated using theory. The calculated indentor loads using the plane surface integration were within 8 to 30% of the measured loads. Calculated loads using a cylindrical integration surface were only within 40 to 50% of the measured loads due to stress sensor resolution limitations. The surface integral method is a viable way to calculate structural ice loads using in-situ stress measurements. Accuracy of the load calculations is limited by the fidelity of representing the stress along the surface of the integration using widely-spaced stress measurements.

MP 2354
MUKLUK ICE STRESS MEASUREMENT PROGRAM
Cox, G.F.N. et al
International Conference on Port and Ocean Engineering under Arctic Conditions, 9th, Fairbanks, AK, Aug. 17-22, 1987. Proceedings, Vol.1. Edited by W.M. Sackinger and M.O. Jeffries. (Port and ocean engineering under Arctic conditions)
Fairbanks, University of Alaska, Geophysical Institute, 1988 p.457-463
8 refs.

42-3580

Johnson, J.B. Bosworth, H.W. Vincent, T.J.
Ice loads, Artificial islands, Stresses, Tensile properties, Compressive properties, Gravel, Ice mechanics, Ice strength, Ice salinity, Shear stress, Beaufort Sea
During the spring of 1985, 23 biaxial ice stress sensors were deployed at seven sites around Mukluk, a man-made gravel island in Harrison Bay in the Beaufort Sea. The maximum measured compressive and tensile stresses were 240 and 340 kPa, respectively. However, stresses were usually less than 100 kPa and seldom exceeded 200 kPa. There were no major storms, and net ice motions varied from 1.5 to 5.3 m during the measurement program. While significant warming of the ice sheet occurred during the latter part of the study, thermal ice stresses were much lower than those previously measured in Mackenzie Bay. This may be due to the fact that the ice in Harrison Bay was more saline and had a lower modulus and yield strength than the ice in Mackenzie Bay.

MP 2355

FOX PERMAFROST TUNNEL: A LATE QUATERNARY GEOLOGIC RECORD IN CENTRAL ALASKA

Hamilton, T.D. et al

Geological Society of America. Bulletin June 1988 100(6) p.948-969

70 refs.

42-3857

Craig, J.L. Sellmann, P.V.

Permafrost, Tunnels, Geologic structures, Quaternary deposits

MP 2356

DIELECTRIC PROPERTIES OF STRAINED ICE. 1: EFFECT OF PLASTIC STRAINING

Itagaki, K.

Journal de physique (Colloque C1) Mar. 1987 48(3 Suppl.)

Symposium on the Physics and Chemistry of Ice, 7th, Grenoble, France, Sep. 1-5, 1986. [Proceedings]

p.143-147

5 refs.

With French summary.

42-3792

Ice electrical properties, Ice relaxation, Ice plasticity, Electrodes, Dielectric properties, Strain tests

The effect of plastic straining on single crystals of ice was examined. As strain increased plastically, relaxation strength increased linearly as the relaxation time increased.

MP 2357

DIELECTRIC PROPERTIES OF STRAINED ICE. 2: EFFECT OF SAMPLE PREPARATION METHOD

Itagaki, K. et al

Journal de physique (Colloque C1) Mar. 1987 48(3 Suppl.)

Symposium on the Physics and Chemistry of Ice, 7th, Grenoble, France, Sep. 1-5, 1986. [Proceedings]

p.149-153

5 refs.

With French summary.

42-3793

Lemieux, G.E.

Ice electrical properties, Ice crystal structure, Ice sampling, Electrodes, Dielectric properties, Strain tests, Freezing

Since most commonly used sample preparation methods for ice dielectric studies involve rather heavy mechanical straining, the effects of straining were studied and compared with more strain-free sample preparation methods.

MP 2358

PRELIMINARY STUDY OF FRICTION BETWEEN ICE AND SLED RUNNERS

Itagaki, K. et al

Journal de physique (Colloque C1) Mar. 1987 48(3 Suppl.)

Symposium on the Physics and Chemistry of Ice, 7th, Grenoble, France, Sep. 1-5, 1986. [Proceedings]

p.297-301

5 refs.

With French summary.

42-3811

Lemieux, G.E. Huber, N.P.

Ice friction, Sleds, Water films, Ice melting, Temperature effects, Lubricants, Models

The effects of runner material and surface conditions on the friction between runners and ice were studied by measuring the velocity of a free-sliding sled. Smooth runners showed lower friction at around -1 C than around -10 C as expected, but the friction of rough runners showed little temperature dependence.

MP 2359

ON THE MICROMETEOROLOGY OF SURFACE HOAR GROWTH ON SNOW IN MOUNTAINOUS AREA

Colbeck, S.C.

Boundary-layer meteorology July 1988 44(1-2)

p.1-12

15 refs.

42-3938

Hoarfrost, Snow surface, Snow air interface, Turbulence

MP 2360

NATURAL GROUND TEMPERATURES IN UPLAND BEDROCK TERRAIN, INTERIOR ALASKA

Collins, C.M. et al

International Conference on Permafrost, 5th, Trondheim, Norway, Aug. 2-5, 1988. Proceedings, Vol.1. Edited by K. Senneset

Trondheim, Norway, Tapir Publishers, [1988] p.56-60

20 refs.

42-3984

Haugen, R.K. Kreig, R.A.

Taiga, Permafrost thermal properties, Soil temperature, Discontinuous permafrost, Slope orientation, Vegetation, Altitude, Topographic effects, United States--Alaska

Surface and subsurface ground temperature measurements were made in drill holes representing a variety of permafrost/non-permafrost, slope exposure, elevation, vegetation, and soil conditions within the upland taiga of interior Alaska. Algorithms representing equivalent latitude and air temperature/elevation relationships are developed to more precisely define permafrost/non-permafrost boundaries within this complex terrain.

MP 2361

MICROSTRUCTURE OF FROZEN SOILS EXAMINED BY SEM

Kumai, M.

International Conference on Permafrost, 5th, Trondheim, Norway, Aug. 2-5, 1988. Proceedings, Vol.1. Edited by K. Senneset

Trondheim, Norway, Tapir Publishers, [1988] p.390-395

8 refs.

42-4049

Frozen ground physics, Soil structure, Microstructure, Scanning electron microscopy, X ray analysis, Clay, Porosity, Ice sublimation, Chemical analysis, Grain size

Physical properties of bentonite, dickite and sand samples for freezing experiments were examined with a scanning electron microscope (SEM), and elemental compositions were measured with an energy dispersive x-ray (EDX) analyzer. Bentonite from Umiat, Alaska, is a typical cold-regions swelling clay with thin, crumpled and folded structures. The soil samples with relatively high water contents were frozen, and the frozen characteristics were examined with the SEM equipped with a cold stage. SEM images of frozen bentonite and dickite showed characteristic segregated ice and coagulated soil patterns formed during freezing processes and porous structures formed during the sublimation stage of ice in frozen soils. However, frozen sand showed no typical ice segregation and sand grain coagulation because of the large grain size. The freeze sublimation process of frozen clay and silt increases the permeability to water vapor because of the porous structure formation.

MP 2362

METHOD FOR MEASURING THE RATE OF WATER TRANSPORT DUE TO TEMPERATURE GRADIENTS IN UNSATURATED FROZEN SOILS

Nakano, Y. et al

International Conference on Permafrost, 5th, Trondheim, Norway, Aug. 2-5, 1988. Proceedings, Vol.1. Edited by K. Senneset

Trondheim, Norway, Tapir Publishers, [1988] p.412-417

7 refs.

42-4053

Tice, A.R.

Temperature gradients, Frozen ground temperature, Soil water migration, Saturation, Water content, Analysis (mathematics)

A new experimental method is introduced to determine the rate of water movement caused by temperature gradients in unsaturated frozen soils. When a linear temperature distribution is imposed on a closed soil column with initially a uniform water content, a redistribution of water occurs in the column. As time increases, the profile of water is stabilized to approach a stationary profile, which is used to calculate the rate of water movement due to temperature gradients. The theoretical justification of the method is presented and the feasibility of the method is demonstrated by experiments with a marine-deposited clay.

MP 2363

MEASUREMENT OF THE UNFROZEN WATER CONTENT OF SOILS: A COMPARISON OF NMR AND TDR METHODS

Smith, M.W. et al

International Conference on Permafrost, 5th, Trondheim, Norway, Aug. 2-5, 1988. Proceedings, Vol.1. Edited by K. Senneset

Trondheim, Norway, Tapir Publishers, [1988] p.473-477

10 refs.

42-4064

Tice, A.R.

Unfrozen water content, Soil water, Frozen ground, Temperature effects, Dielectric properties, Experimentation, Nuclear magnetic resonance, Reflectivity, Water content

A laboratory testing program was carried out to compare two independent methods for determining the unfrozen water content of soils. With the TDR method, the unfrozen water content is inferred from a calibration curve of apparent dielectric constant versus volumetric water content, determined by experiment. Previously, precise calibration of the TDR technique was hindered by the lack of a reference comparison method, which NMR now offers. This has provided a much greater scope for calibration, including a wide range of soil types and temperatures (unfrozen water content). The results of the testing program yielded a relationship between dielectric constant and volumetric unfrozen water content that is largely unaffected by soil type, although a subtle but apparent dependency on the texture of the soil was noted. It is suggested that this effect originates from the lower valued dielectric constant for absorbed soil water. In spite of this, the general equation presented may be considered adequate for most practical purposes. The standard error estimate is 0.015 cu cm/cu cm, although, if desirable, this may be reduced by calibrating for individual soils. Brief guidelines on system and probe design are offered to help ensure that use of the TDR method will give results consistent with the relationship presented.

MP 2364

BOREHOLE INVESTIGATIONS OF THE ELECTRICAL PROPERTIES OF FROZEN SILT

Arcone, S.A. et al

International Conference on Permafrost, 5th, Trondheim, Norway, Aug. 2-5, 1988. Proceedings, Vol.2. Edited by K. Senneset

Trondheim, Norway, Tapir Publishers, [1988] p.910-915

16 refs.

42-4148

Delaney, A.J.

Frozen ground physics, Electrical properties, Boreholes, Ground ice, Frozen ground temperature, Dielectric properties, Attenuation, Sediments, Water content

The dielectric constant and attenuation rate of short [illegible] pulses in frozen Fairbanks silt have been measured between boreholes [illegible] and spaced between [illegible] and 17.[illegible] m. The ranges for volumetric ice content and temperature were [illegible] to 74% and -6.0 (surface, early Apr.) to -0.7 C (bottom) respectively. The pulses lasted approximately [illegible] ns, had a power spectrum centered near 100 MHz, and were transmitted and received at the same depth. Dielectric constants were determined from the propagation time delay of the [illegible] leading edge and there was no significant dispersion. Attenuation rates (dB/m) were determined by comparing signal levels received between different borehole pairs and were adjusted for geometric spreading losses. Concurrent borehole DC resistivity measurements allowed estimates of the separate contributions of various loss mechanisms. The results show the dielectric constant to vary between 4.8 and 7.0 and to correlate well with the volumetric ice content, but not with temperature. Average attenuation rates at any particular depth varied between 1.4 and 4.0 dB/m. The lowest values occurred in the sections with the highest ice content. No more than 0.8 dB/m could be ascribed to conductive absorption losses, suggesting that scattering is an important loss mechanism.

MP 2365

SEASONAL VARIATIONS IN RESISTIVITY AND TEMPERATURE IN DISCONTINUOUS PERMAFROST

Delaney, A.J. et al

International Conference on Permafrost, 5th, Trondheim, Norway, Aug. 2-5, 1988. Proceedings, Vol.2. Edited by K. Senneset

Trondheim, Norway, Tapir Publishers, [1988] p.927-932

16 refs.

42-4151

Sellmann, P. Arcone, S.

Discontinuous permafrost, Permafrost thermal properties, Electrical resistivity, Frozen ground physics, Boreholes, Sediments, Unfrozen water content, Grain size, Frozen ground temperature

Electrical resistivity and temperature were measured in two 12.2-m-deep boreholes in interior Alaska in perennially frozen ice-rich silt and in coarse-grained alluvium. Seasonal temperature and resistivity changes were most noticeable in the upper 6 m at both sites, with resistivity varying more than several thousand ohm-m during the year. Resistivity profiles were compared with lithology, temperature and moisture content. At the alluvium site resistivity and grain size strongly correlated. Values ranging over 10,000 ohm-m occurred with coarse-grained material and values an order of magnitude lower occurred in the fine-grained material section. At the ice-rich silt site, resistivity values were generally lower, but in agreement with values for the fine-grained part of the alluvial section. Lithologic variations in the discontinuous permafrost zone can be as important as the high permafrost temperatures and correspondingly large unfrozen water contents in accounting for significant seasonal resistivity changes in fine-grained sediment.

MP 2366

D.C. RESISTIVITY ALONG THE COAST AT PRUDHOE BAY, ALASKA

Sellmann, P.V. et al

International Conference on Permafrost, 5th, Trondheim, Norway, Aug. 2-5, 1988. Proceedings, Vol.2. Edited by K. Senneset

Trondheim, Norway, Tapir Publishers, [1988] p.[illegible]

11 refs.

42-4162

Delaney, A.J. Arcone, S.A.

Subsea permafrost, Permafrost distribution, Tundra, Models, Permafrost physics, Shoreline modification, Electrical resistivity, Soundings, Shore erosion, United States--Alaska--Prudhoe Bay

Electrical resistivity measurements, at three sites [illegible] Prudhoe Bay, Alaska, were made to provide an understanding of marine modification of coastal permafrost, and to evaluate D.C. resistivity techniques for coastal subsea permafrost studies. [illegible] measurements were made using Schlumberger [illegible] resistivity soundings. Profiles extended [illegible] offshore and inland beyond the limit of [illegible] modification by coastal processes. [illegible] measurements were made with a floating cable, and inland measurements were made using [illegible]. The observations indicate that the electrical properties of permafrost beneath the coastal [illegible] adjacent tundra are rapidly [illegible] by coastal erosion and periodic flooding during storms. Along one control line, apparent resistivity changes corresponded with the configuration of the top of ice-bonded permafrost observed by [illegible] (1987). [illegible] supported by the control data permitted a [illegible] interpretation of the position of the top of ice-bonded subsea permafrost and provided a range of [illegible] resistivities for offshore materials.

MP 2367
FROST HEAVE FORCES ON H AND PIPE FOUNDATION PILES
Buska, J.S. et al
International Conference on Permafrost, 5th, Trondheim, Norway, Aug. 2-5, 1988. Proceedings, Vol.2. Edited by K. Senneset
Trondheim, Norway, Tapir Publishers, [1988] p.1039-1044
5 refs.
42-4173
Johnson, J.B.
Frost heave, Pile extraction, Pipeline supports, Shear stress, Loads (forces), Active layer, Adhesion, Foundations, Air temperature, Frozen ground temperature, United States--Alaska--Fairbanks
The magnitude and variation of forces and shear stresses, caused by frost heaving in Fairbanks silt and the adfreeze effects of a surface ice layer and a gravel layer, were determined as a function of depth along the upper 2.75 m of a pipe pile and an H pile for three consecutive winter seasons (1982-1985). The peak frost heaving forces on the H pile during each winter were 752, 790 and 802 kN. Peak frost heaving forces on the pipe pile of 1118 and 1115 kN were determined only for the second and third winter seasons. Maximum average shear stresses acting on the pipe pile were 627 and 972 kPa for the second and third winter seasons. The surficial ice layer may have contributed 15 to 20% of the peak forces measured on the piles. The gravel layer on the H pile contributed about 35% of the peak forces measured.

MP 2368
NEW FREEZING TEST FOR DETERMINING FROST SUSCEPTIBILITY
Chamberlain, E.J.
International Conference on Permafrost, 5th, Trondheim, Norway, Aug. 2-5, 1988. Proceedings, Vol.2. Edited by K. Senneset
Trondheim, Norway, Tapir Publishers, [1988] p.1045-1050
5 refs.
42-4174
Frost resistance, Soil freezing, Pavements, Frost heave, Artificial freezing, Tests, Freeze thaw cycles, Temperature control, Equipment
A new freezing test for determining the frost susceptibility of soils used in pavement systems is designed to supplant the standard CRREL freezing test. This new test cuts the time required to determine frost susceptibility in half. It also allows for the determination of both the frost heave and thaw weakening susceptibilities and considers the effects of freeze-thaw cycling. The new freezing test also eliminates much of the variability in test results by completely automating the temperature control and the data observations.

MP 2369
USE OF GEOTEXTILES TO MITIGATE FROST HEAVE IN SOILS
Henry, K.
International Conference on Permafrost, 5th, Trondheim, Norway, Aug. 2-5, 1988. Proceedings, Vol.2. Edited by K. Senneset
Trondheim, Norway, Tapir Publishers, [1988] p.1096-1101
14 refs.
42-4183
Frost heave, Frozen ground mechanics, Materials, Geotextiles, Grain size, Water table, Countermeasures, Soil water migration, Capillarity, Porosity
One potential use of geotextiles is horizontal placement in soil above the water table to act as a capillary break or barrier to mitigate frost heave. A capillary break works because larger pore sizes and/or wetting angles of the material than surrounding soil result in lower unsaturated hydraulic conductivity and lowered height of capillary rise of water. This reduces frost heave by limiting the rate of upward water migration. Five series of open-system, unidirectional frost-heave tests were run in which 3 nonwoven polypropylene geotextiles were tested for their ability to mitigate frost heave. Certain fabrics were successful in reducing frost heave by as much as 35%. Test results also indicate that the optimum fabric thickness required to mitigate frost heave is a function of soil type as well as properties of the geotextile.

MP 2370
EFFECT OF VARIABLE THERMAL PROPERTIES OF FREEZING WITH AN UNFROZEN WATER CONTENT
Lunardini, V.J.
International Conference on Permafrost, 5th, Trondheim, Norway, Aug. 2-5, 1988. Proceedings, Vol.2. Edited by K. Senneset
Trondheim, Norway, Tapir Publishers, [1988] p.1127-1132
17 refs.
42-4189
Freezing points, Thermal conductivity, Unfrozen water content, Heat transfer, Permafrost thermal properties, Phase transformations, Temperature effects, Ground thawing, Analysis (mathematics)
While many materials undergo phase change at a fixed temperature, the variation of unfrozen water with temperature causes a soil system to freeze or thaw over a finite temperature range. Exact and approximate solutions are given for conduction phase change of plane layers of soil with unfrozen water contents that vary linearly and quadratically with temperature. The temperatures and phase change depths are found to vary significantly from those predicted for the constant temperature (Neumann) problem. The thermal conductivity and specific heat of the soil within the mushy zone varied as a function of unfrozen water content. The effect of specific heat is negligible and the effect of variable thermal conductivity can be accounted for by a proper choice of thermal properties used in the constant thermal property solution.

MP 2371
TRIAXIAL COMPRESSIVE STRENGTH OF FROZEN SOILS UNDER CONSTANT STRAIN RATES
Zhu, Y. et al
International Conference on Permafrost, 5th, Trondheim, Norway, Aug. 2-5, 1988. Proceedings, Vol.2. Edited by K. Senneset
Trondheim, Norway, Tapir Publishers, [1988] p.1200-1205
10 refs.
42-4204
Carbee, D.L.
Frozen ground strength, Strain tests, Compressive properties, Frozen ground mechanics, Stresses, Sands, Deformation, Loads (forces), Shear strength
Triaxial compressive strength tests were conducted on remolded, saturated Fairbanks silt and Northwest sand taken from Alaska under various constant strain rates ranging from 5.27/10,000,000 to 9.84/10,000/s and confining pressures up to 3.43 MPa at -2 C. The average dry density of the samples tested were 1.20 g/cu cm for silt and 1.52 g/cu cm for sand, respectively. It was found that, within the range of confining pressure employed, the maximum deviator stress for the silt did not vary.

MP 2372
DEVELOPING A THAWING MODEL FOR SLUDGE FREEZING BEDS
Martel, C.J.
International Conference on Permafrost, 5th, Trondheim, Norway, Aug. 2-5, 1988. Proceedings, Vol.2. Edited by K. Senneset
Trondheim, Norway, Tapir Publishers, [1988] p.1426-1430
7 refs.
42-4247
Sludges, Thaw depth, Freeze thaw cycles, Dewatering, Waste treatment, Water treatment, Mathematical models, Forecasting, Drying, Freezing
This paper presents the development of a model that can be used to predict the thawing design depth of a sludge freezing bed. A sludge freezing bed is a new unit operation for dewatering sludges from water and wastewater treatment plants. Preliminary results obtained from a pilot-scale freezing bed indicate that this model is valid.

MP 2373
OBSERVATIONS OF MOISTURE MIGRATION IN FROZEN SOILS DURING THAWING
Cheng, G. et al
International Conference on Permafrost, 5th, Trondheim, Norway, Aug. 2-5, 1988. Proceedings, Vol.1. Edited by K. Senneset
Trondheim, Norway, Tapir Publishers, [1988] p.308-312
14 refs.
42-4032
Chamberlain, E.J.
Ground thawing, Soil water migration, Frozen ground, Water content, Tests, Ice lenses, Frost heave, Ice formation
Open and closed system tests on prefrozen silt and clay were conducted to investigate moisture migration in frozen soils during thawing. In all tests, an increase in water content just below the thawing front was observed. In some cases, a thawing fringe, ice lenses and frost heave were recorded. Water migration into the frozen part of thawing soil was greatly reduced after a continuous ice lens had formed across a sample. A regelation mechanism for ice formation in frozen soil during thawing is suggested.

MP 2379
ARCTIC RESEARCH OF THE UNITED STATES, VOL.2
Interagency Arctic Research Policy Committee
Washington, D.C., Spring 1988 76p.
For selected papers see 42-4274 through 42-4276.
42-4273
Brown, J. ed Cate, D. ed Bowen, S.L. ed Valliere, D.S. ed
Research projects, Polar regions, Data processing, Meetings
The articles in this first issue of 1988 are divided into three main sections. The first focuses on non-Federal research in Alaska and selected Federal support activities involving data and information acquisition, storage and dissemination. The second section presents reports on meetings and activities of international interest predominantly originating outside the U.S. The third section contains brief reports of other Arctic research activities, primarily in the U.S. Reports of meetings of the Arctic Research Commission and the Interagency Committee and notices of upcoming meetings are a regular feature of the journal.

MP 2380
ALASKA SAR FACILITY: AN UPDATE
Weller, G. et al
Arctic research of the United States, Spring 1988 Vol.2 p.27-31
5 refs.
42-4274
[illegible], W.F.
Data processing, Sea ice, Radar echoes

MP 2381
FRAZIL ICE IN RIVERS AND STREAMS
Daly, S.F.
Northern engineer Fall/winter 1987 19(3-4) p.14-2[illegible]
For another source see 42-163. 54 refs.
42-4284
Frazil ice, Supercooling, Laboratory techniques

MP 2382
ON THE EFFECT OF THE 4 C DENSITY MAXIMUM ON MELTING HEAT TRANSFER
Yen, Y.-C.
International Symposium on Phase Change Heat Transfer, Chongqing, Sichuan, China, May 20-25, 1988. Proceedings. Advances in phase change heat transfer. Edited by M. Xin
Beijing, China, International Academic Publishers, 1988 p.362-367
15 refs.
42-4309
Heat transfer, Ice melting, Ice water interface, Density (mass/volume), Convection, Analysis (mathematics)
The effect of the 4 C density maximum on heat transfer in a water layer formed by melting ice has been investigated. The anomalous density maximum of water at about 4 C has been attributed to the occurrence of a constant temperature region within the layer and has resulted in variable critical Rayleigh numbers dependent on both the warm boundary temperature and the direction of melting.

MP 2383
PHASE CHANGE HEAT TRANSFER PROGRAM FOR MICROCOMPUTERS
[illegible], G.M. et al
International Symposium on Phase Change Heat Transfer, Chongqing, Sichuan, China, May 20-25, 1988. Proceedings. Advances in phase change heat transfer. Edited by M. Xin
Beijing, China, International Academic Publishers, 1988 p.645-650
22 refs.
42-4312
Farag, I.H. Piettaplace, J.
Heat transfer, Phase transformations, Computers, Electric equipment, Freeze thaw cycles, Melting, Analysis (mathematics), Freezing, Latent heat
The development of a microcomputer based finite element program featuring phase change (melting and freezing) simulation facilities is outlined. A closed form Galerkin finite element method derived from a delta function formulation of the latent heat discontinuity in the heat capacity versus temperature function is used within phase change elements of the solution domain. Storage reduction data structures are implemented and compared on the basis of overall program execution time. Analytical solutions for melting and freezing are used to verify program accuracy and to explore other simulation parameters such as time step size, mesh density and start-up technique. Several "life like" phase change simulations are compared to the results obtained from other numerical models; main frame and microcomputer performance based on execution time is tabulated for each of these cases.

Daly, S.F.
Ice atlas, 1984-1985: Ohio River, Allegheny River, Monongahela River, 1986, 185p.
SR 86-23
River ice mapping with Landsat and video imagery, 1987, p.352-353
MP 2273
Modelling trash rack freezeup by frazil ice, 1987, p.101-105
MP 2305
Evolution of frazil ice in rivers and streams: research and control, 1987, p.11-16
MP 2303
Frazil ice in rivers and streams, 1987, p.19-26
MP 2381
Ice atlas 1985-1986: Monongahela River, Allegheny River, Ohio River, Illinois River, Kankakee River, 1987, 357p.
SR 87-20
On the application of thermosyphons in cold regions, 1988, p.281-286
MP 2321

Danyluk, L.S.
Stabilization of fine-grained soil for road and airfield construction, 1986, 37p.
SR 86-21

Dattilo, R.S.
Rating system for unsurfaced roads to be used in maintenance management, 1987, p.(2)51-(2)62
MP 2313

Davidson, K.
MIZEX--a program for mesoscale air-ice-ocean interaction experiments in Arctic marginal ice zones. 8. A science plan for a winter marginal ice zone experiment in the Fram Strait/Greenland Sea: 1987/89, 1986, 53p.
SR 86-09

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Mine detection using non-sinusoidal radar. Part 1: Spatial analysis of laboratory test data, 1984, 99p.
SR 84-22

Delaney, A.J.
Model studies of surface noise interference in ground-probing radar, 1985, 23p.
[illegible]
Short-pulse radar investigations of freshwater ice sheets and brash ice, 1986, 10p.
CR 86-05
Morphology, hydraulics and sediment transport of an ice-covered river. Field techniques and initial data, 1986, 37p.
CR 86-11
Preparation and description of a research geophysical borehole site containing massive ground ice near Fairbanks, Alaska, 1987, 15p.
SR 87-07
Airborne river-ice thickness profiling with helicopter-borne UHF short-pulse [illegible], p.330-340
MP 2312
Field observations [illegible] in snow using UHF short pulse radar [illegible]
SR 87-19
Seasonal variations in resistivity and temperature in discontinuous permafrost, 1988, p.927-932
MP 2365
D.C. resistivity along the coast at Prudhoe Bay, Alaska, 1988, p.988-993
MP 2366
Borehole investigations of the electrical properties of frozen silt, 1988, p.910-915
MP [illegible]

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Flexure and fracture of macrocrystalline S1 type freshwater ice, 198[illegible], p.39-46
MP 2318
Experimental determination [illegible] of the fracture toughness of urea model ice, [illegible]
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Bank conditions [illegible] reservoirs, 1987, p.143-15[illegible]
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Triaxial testing of first-year sea ice, 19[illegible], [illegible]p.
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Resilient modulus of freeze-thaw affected granular soils for pavement design and evaluation. Part 3. Laboratory tests on soils from Albany County Airport, 1987, 36p.
CR 87-02

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SR 86-28
Summary of proper cold weather pavement repair methods, 1987, p.1013-1027
MP 2235
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SR 87-15

Egelhofer, K.Z.
Computer modeling of atmospheric ice accretion and aerodynamic loading of transmission lines, 1987, p.103-109
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MP 2226

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CR 86-13

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Parameters affecting the kinetic friction of ice, 1987, p.552-561
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MP [illegible]

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Portable hot water ice drill, 1986, p.549-564
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Hudson River ice management, 1985, p.96-110
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Preliminary simulation of the formation and infilling of sea ice gouges, 1986, p.259-268
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MP 2240

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Alaska SAR facility, 1988, p.103-110
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of sea ice gouges, Weeks, W.F. et al, 1986, p.259-258
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CR 88-04

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